AVIATION WEEK

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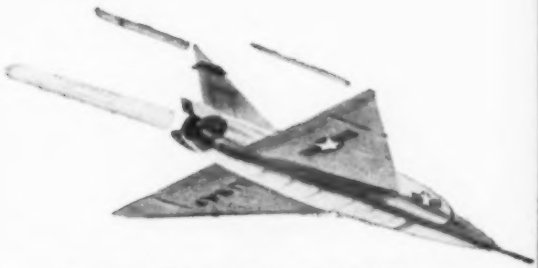
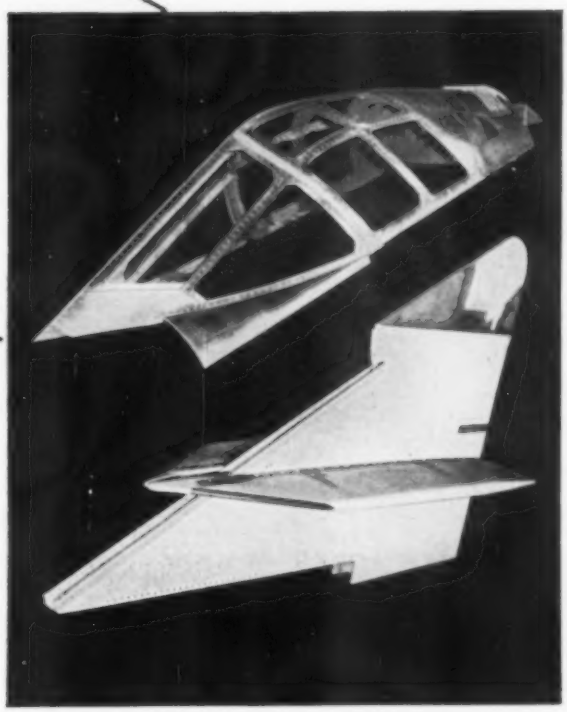
THESE "EYES" HAVE IT-



for the F-102A!



Out at our Litchfield Park, Arizona, facilities, we've fashioned a pair of "eyes" for one of the world's foremost interceptor aircraft—and the folks at Convair tell us the results are right on the button.

First there is the sleek and razor-sharp windshield assembly and the canopy assembly for the F-102A's rakish profile—an excellent example of close-tolerance metalcrafting by Goodyear Aircraft Corporation.

Then there is the thin and sturdy fin cap which must weave a wealth of sensitive electronic "seeing" equipment within a structure hardly thicker than a thumb. In order to house wave guide and omnirange antennas, parasitic, IFF and UHF antennas and a dielectric coupler in this sensitive structural portion of the aircraft—Goodyear Aircraft was called upon to integrate a host of special materials which insure electronic transmissibility, strength and high performance within the exacting confines of a thin airfoil section.

As a result, this fin tip structural assembly is a close-tolerance combination of bonded metal honeycomb with aluminum facings, pressure-molded fiber-reinforced alkyd resin, foamed-in-place plastic and a special rain-resistant coating developed by Goodyear called "23-56."

These components for the F-102A are interesting examples of the metal-working skills and the integration of special structural materials offered by Goodyear Aircraft in the service of air progress.

For information, write: Goodyear Aircraft Corporation, plants in Akron, Ohio, and Litchfield Park, Arizona.

They're doing big things at

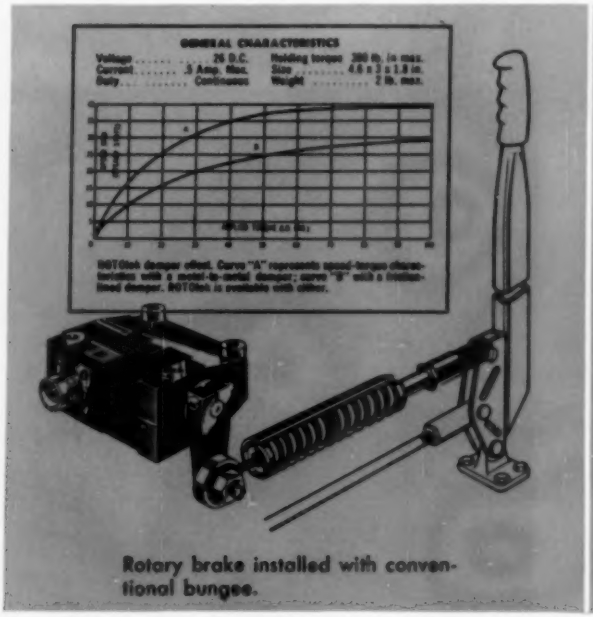
GOODYEAR AIRCRAFT

THE INFORMATION ON THIS PAGE IS TYPICAL OF THE DATA YOU WILL FIND IN THE NEW AIRBORNE CATALOG

BUNGEE CONTROL SYSTEMS

R-460-Rotary
(variable anchor)

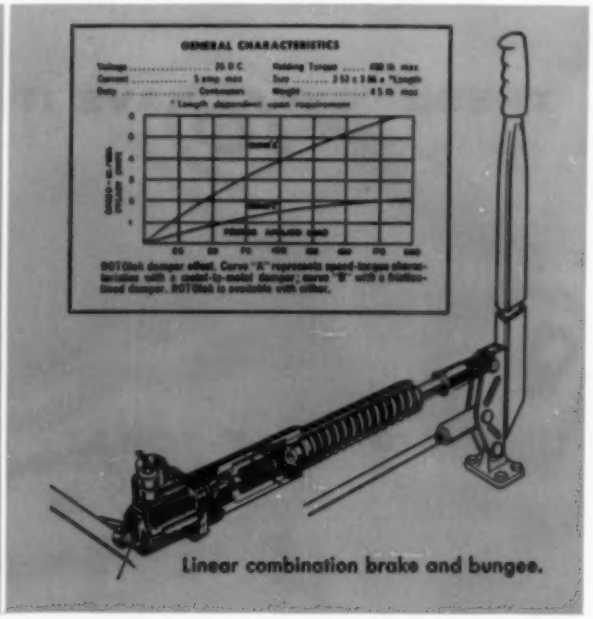
350 in. lb. max. brake holding capacity.



Rotary brake installed with conventional bungee.

R-590-Linear
(variable link)

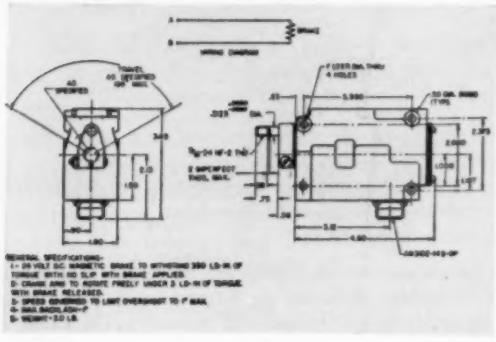
480 lb. max. brake holding capacity.



Linear combination brake and bungee.

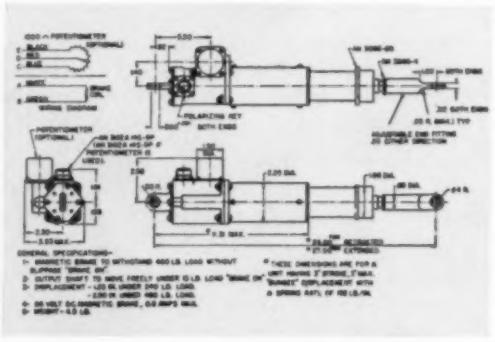
These units are available in other configurations to meet specific torque and steady state speed requirements.

MAGNETIC BRAKE. First designed for control applications in rotary wing aircraft, it has now been applied successfully to fixed wing aircraft. This unit, employed as a variable anchor or link, is most commonly used to cancel out a stick force or for bungee zeroing. In use, the brake is normally on and is energized to release, allowing connected load to "free wheel." These units are available in either rotary or linear configuration and with or without bungee spring.



Special design features are available to meet specific customer requirements:

- Damping—for "dead beat" to eliminate stick kick
- Wide range of torque or force holding
- Specified values of breakout (friction torque or force)
- Specified values of back lash or end play



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AVIATION CALENDAR

Apr. 9-12—Society of Automotive Engineers, national aeronautic meeting, aeronautic production forum and aircraft engineering display, Hotel Statler, New York, N. Y.

Apr. 10-11—Symposium for Management on Application of Analog Computers, sponsored by Midwest Research Institute, University of Kansas City, Kansas City, Mo.

Apr. 15-19—Airport Operations Council, 9th annual conference, Hotel Warwick, Philadelphia.

Apr. 16-18—Aero Medical Association, Drake Hotel, Chicago.

Apr. 16-18—American Society of Mechanical Engineers, First Gas Turbine Power Conference, Hotel Statler, New York, N. Y.

Apr. 18-19—First Annual National Industrial Research Conference, sponsored by Armour Research Foundation, Hotel Sherman, Chicago.

Apr. 19-20—Annual Meeting of the Science Section of the Environment Equipment Institute, Sheraton Hotel, Chicago.

Apr. 22-26—American Association of Airport Executives, 29th annual convention, Hotel Carter, Cleveland, Ohio.

Apr. 26—Institute of Navigation, annual regional meeting, Friendship International Airport, Baltimore, Md.

Apr. 26-27—Aeronautical Training Society, annual meeting, Mayflower Hotel, Washington, D. C.

Apr. 26-27—Institute of the Aeronautical Sciences Southeastern Student Conference, Georgia Institute of Technology, Atlanta, Georgia.

Apr. 30-May 4—Society of Aeronautical Weight Engineers, 15th national conference, El Cortez Hotel, San Diego.

May 2-3—Air Traffic Conference of the Air Transport Assn., Spring Meeting, Hotel Radisson, Minneapolis, Minn.

May 2-5—Twelfth Annual National Forum of the American Helicopter Society, Sheraton-Park Hotel, Washington, D. C.

May 3-4—Sixth Annual Institute of Aeronautical Sciences, West Coast Student Conference, Los Angeles.

May 6-9—Second Annual Symposium on Flight Test Instrumentation, sponsored by Instrument Society of America, Bell Aircraft Corp., Convair and Temco Aircraft Corp., Fort Worth, Tex.

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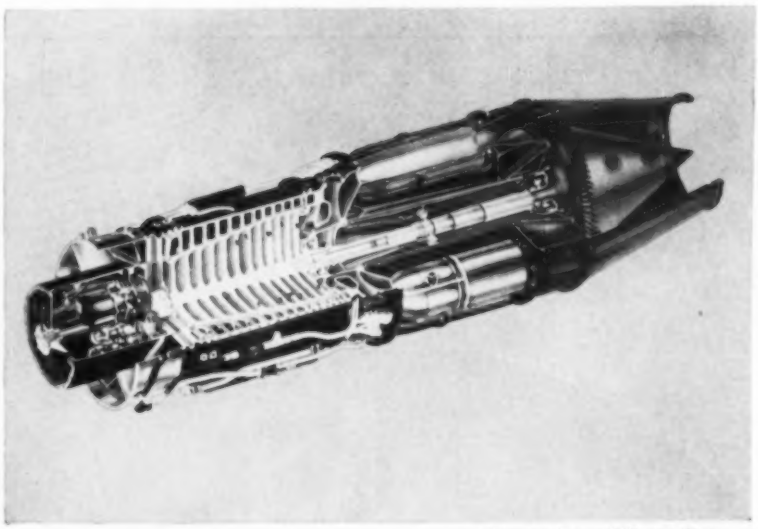

(Courtesy General Electric Co.)

Du Pont Aircraft Rivets are currently being used in new ultra-high-speed engines composed principally of heat-resistant materials.

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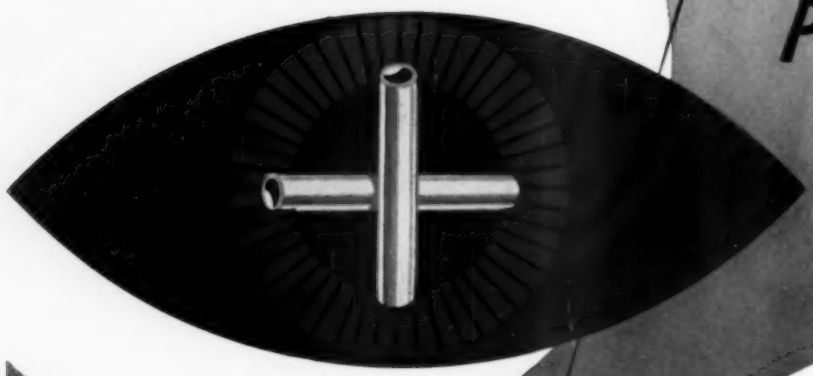

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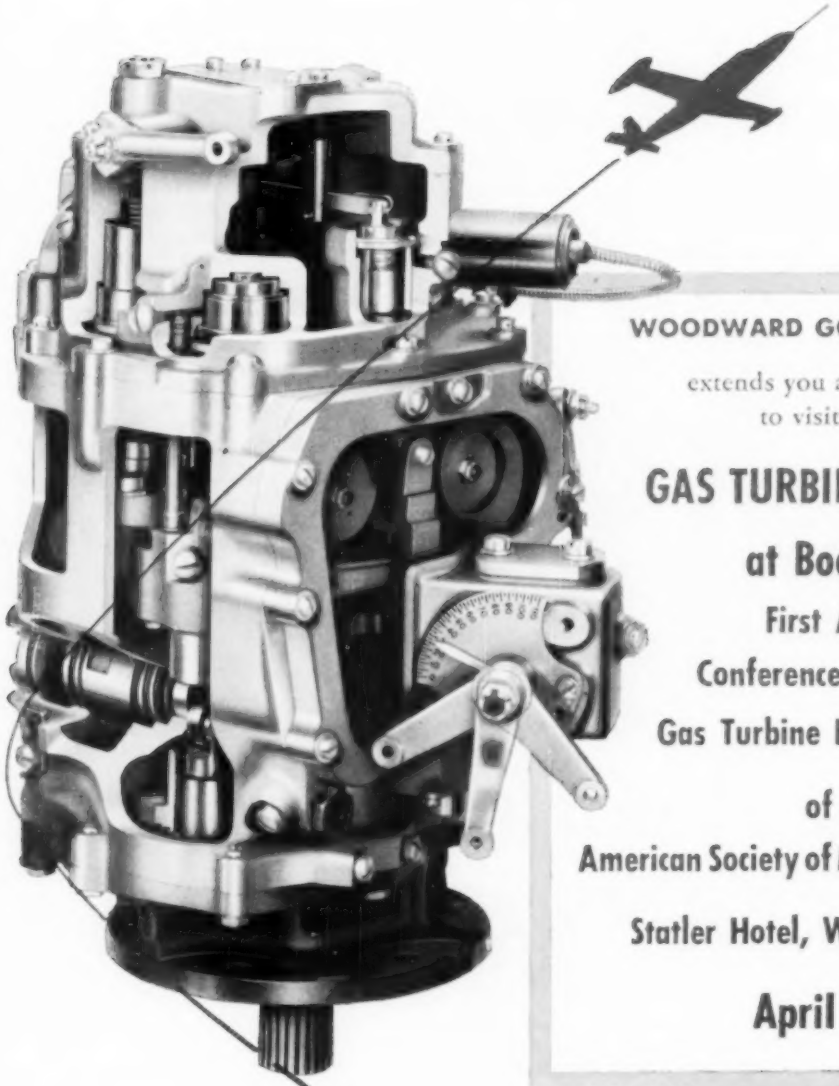

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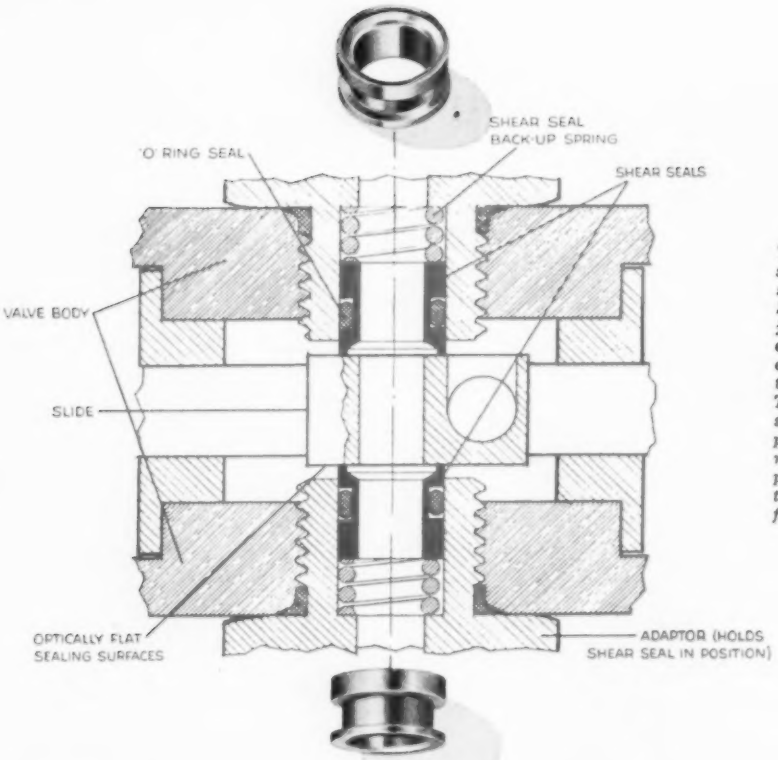

Typical Shear Seal installation in slide type selector valve. Shear Seal requires no adjustment at the time of assembly or at any other period during the life of the valve. They are completely self-adjusting, always pressing against the mating surface with a pressure in proportion to the pressure of the fluid or gas.

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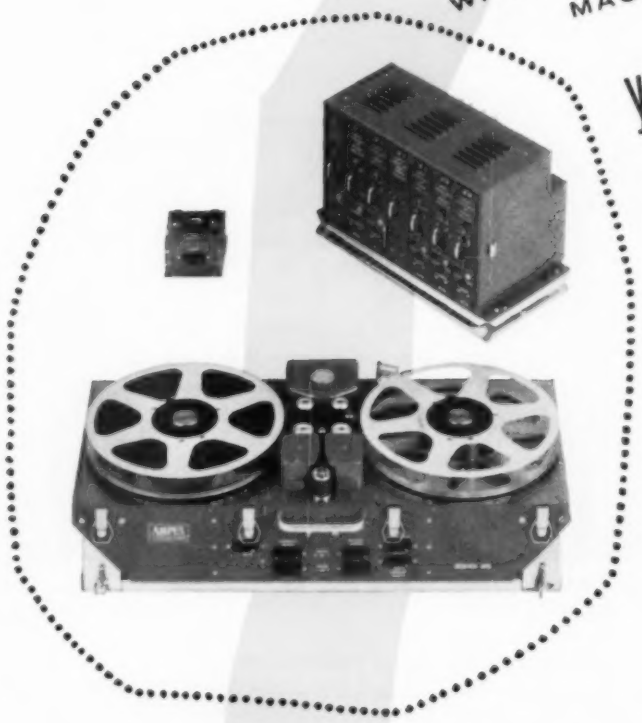

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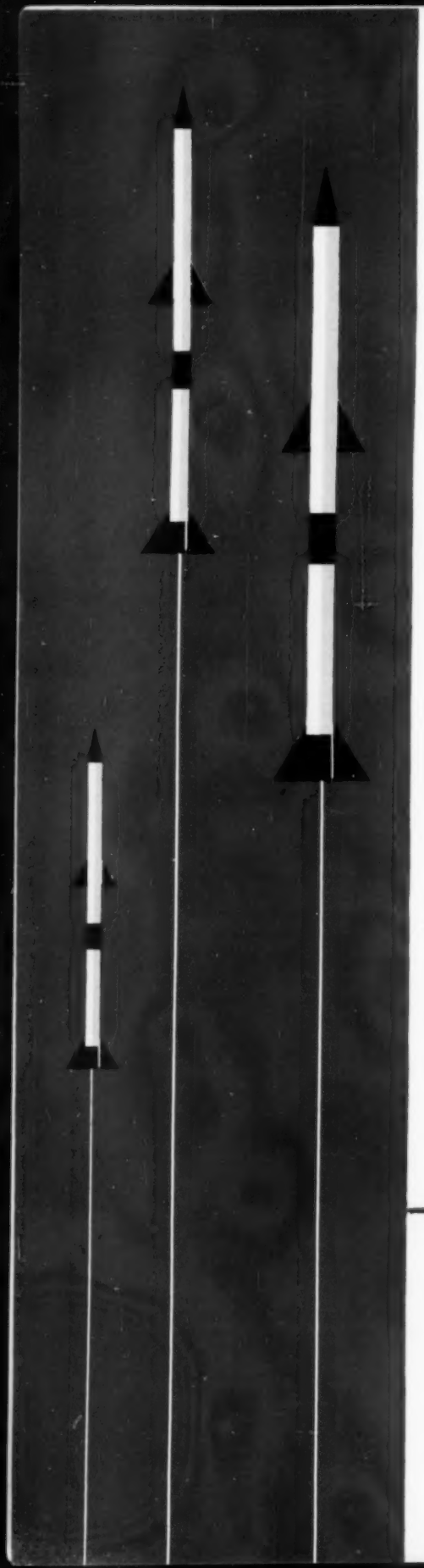

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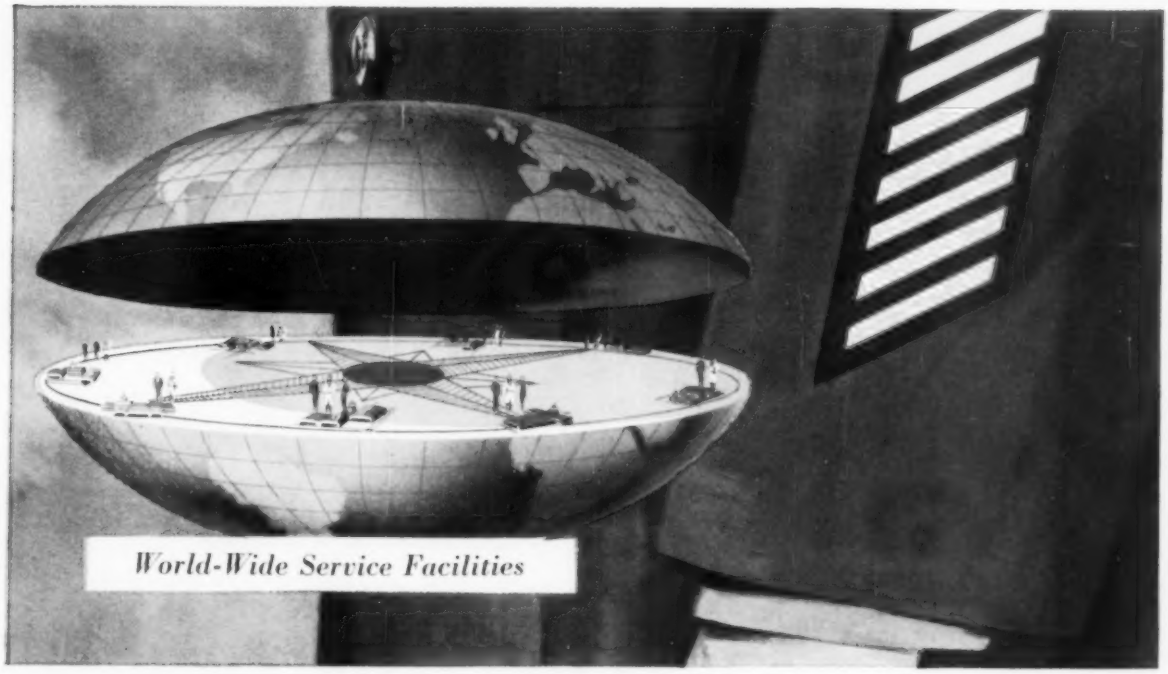

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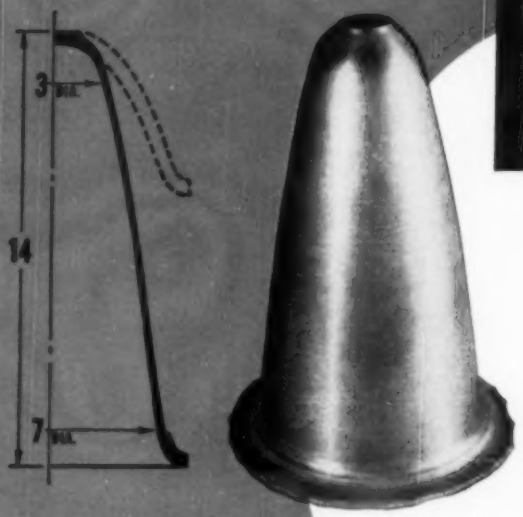


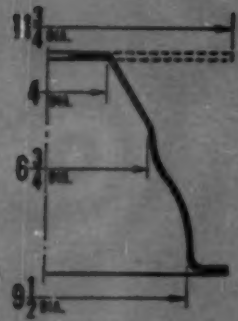
complicated contours cost less by Hydrospinning!

The parts shown here were formed by *tracer* Hydrospinning at substantial reduction in cost over that of previous production methods. These parts were produced in far less time . . . are more accurate . . . have increased strength with greater resistance to fatigue failure . . . required less material . . . and were made without compromising on material requirements.

If difficult-to-form contoured components are one of your production headaches, get the facts on Hydrospinning. Call in a Cincinnati Milling field engineer. For a detailed description of the process and machine specifications, write for new Bulletin M-1873-2.

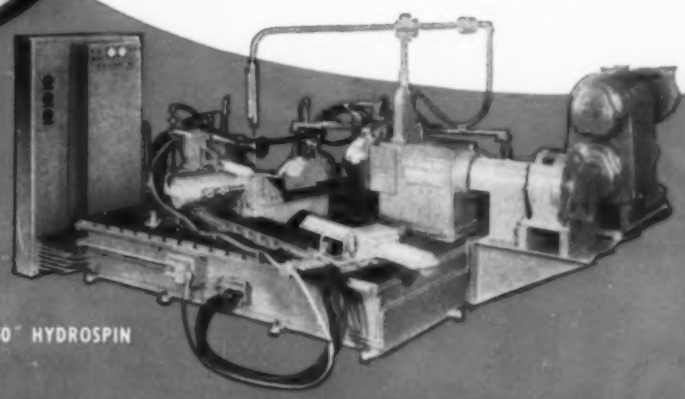
PARABOLIC-SHAPED PART

formed in one pass in two minutes. Starting blank of 61 SO aluminum, 11 3/8" dia. x 3/16" thick, was preformed on a Cincinnati Hydroform.



COMPOUND CONTOURS

of this part were formed in one pass in one minute. Material is mild steel.



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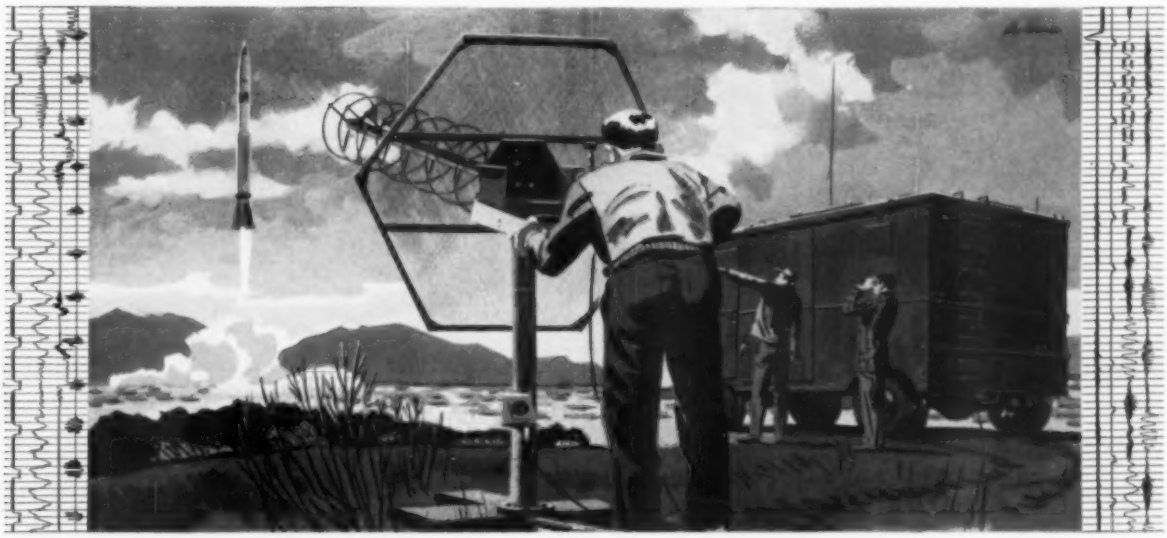

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The success of the Corporal and other JPL guided missile programs is dependent on constantly improved instrumentation techniques. Development, a major portion of the Telemetering Group activity, is directed toward improving system flexibility, accuracy and reliability. This activity is tailored to both immediate and long range instrumentation requirements of the many Laboratory missile programs.

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Corporation executive planes are among the important users of Hazeltine DME. Here James Lamb (left), Chief Pilot, American Oil Company, and his co-pilot pre-check their flight instruments, including the range indicator of their Model 1800 Hazeltine Interrogator (dial upper right, Interrogator lower left). The Interrogator co-ordinates with any DME ground station within range to provide a means of continuous and accurate distance measurement.

Hazeltine—builder of high-accuracy DME—chooses G-E 5-Star Tubes for reliability!

General Electric 5-Star Tubes are specially produced for high reliability and top performance in critical service. 19 G-E 5-Star Tubes of 7 types have been chosen for use in the Model 1800 Interrogator—the airborne unit of Distance Measuring Equipment—manufactured by Hazeltine Electronics Corporation, Little Neck, New York, a pioneer in many fields of electronic application.

Electrical stability, ruggedness, extended tube life—these General Electric 5-Star qualities contribute to DME precision and dependability. Under operating conditions that include severe vibration and extremes of temperature and altitude, 5-Star high-reliability tubes installed in the Hazeltine Interrogator have proved their trustworthiness.

G-E 5-Star Tubes are directly engineered for critical applications. They are precision-made in dust-free, lint-free surroundings. Special testing is rigid and exhaustive. Specify and install the same tube reliability as Hazeltine! G-E 5-Star types for virtually every socket are available to meet your design needs. *General Electric Company, Tube Department, Schenectady 5, New York.*

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162-101

Zenith Plastic Parts Now in 8 Vital Spots of the B-52

As one indication of Zenith Aircraft's broad and constantly expanding service to the aircraft industry in reinforced plastics, Zenith is now producing no less than 8 plastic parts for Boeing's great intercontinental bomber, the B-52:

The nose, chin, belly and tail radomes; two wing tips; the fin insulator and rudder leading edge.

A pioneer in the development of reinforced plastics, Zenith has steadily extended the application of these materials to aircraft until Zenith now has the world's largest plant devoted to the production of reinforced plastics for aircraft.

Vital to this vast operation and warranting your confidence in it are Zenith's three intangibles: experience, ingenuity, practicability. For specific application of Zenith know-how to your problems, contact Engineering Research Division...

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WORLD'S LARGEST PLANT PRODUCING REINFORCED PLASTICS FOR AIRCRAFT

APRIL 2, 1956

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New York—330 W. 42nd St., Phone LOngacre 4-3000 (Night LO 4-3035)
Washington 4, D. C.—National Press Bldg., Phones: NAtional 8-3414, REpublic 7-6630
Los Angeles 17—1125 West Sixth St., MAdison 6-9351

PUBLISHER.....Robert W. Martin, Jr.
EDITOR.....Robert B. Hotz

MANAGING EDITOR.....Alpheus W. Jessup
ASST. MANAGING EDITOR (TECHNICAL) David A. Anderton
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COVER: Sikorsky H-19 recovers Q-19 drone from Holloman Air Development Center test range near Alamogordo, N. M. The Q-19, powered by either four or six cylinder engines and manufactured by Radio Plane, Inc., is used at Holloman as a test vehicle for automatic pilots, servo systems and gyroscopes.

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Member APB and ABC

DOW CORNING CORPORATION

Silicone News

FOR DESIGN ENGINEERS

Accuracy of Delicate Instruments Assured by Silicone Damping Fluids

With remarkably flat viscosity-temperature slopes, Dow Corning 200 Fluids show little change in damping force over extremely wide temperature spans. That's why these silicone fluids are specified for damping vibrations in instruments ranging from the simplest automobile dash board gauges up to the delicate oil well tools made by Halliburton Oil Well Cementing Co., Houston, Texas.

By retaining a practically consistent viscosity from room temperature to bottom-hole temperatures ranging up to 400 F, 200 Fluid helps to keep Halliburton's drift-angle and direction-survey tool accurate within half a degree at angles up to 13°.

"Direction" of the drilling string is shown by a compass with a highly polished "north" arm suspended in a glass-bottomed plastic case filled with a low viscosity silicone fluid.

"Drift inclination" is indicated by the positions and relative angle between two other polished arms which swing freely within a second glass-bottomed case filled with a high viscosity Dow Corning 200 Silicone Fluid.

The two cases are mounted in the tool with their glass windows facing one another. A pair of photoelectric cells located between them is geared and wired to constantly scan and record changes in both dials while the tool is being lowered into the well. *No. 76*

Silastic, the Dow Corning silicone rubber, keeps its shape, stays resilient from —100 to 500 F; resists hot oils and chemicals; withstands weathering ozone and corona; and is an ideal dielectric material. Properties of Silastic are fully detailed in new reference brochure. *No. 77*

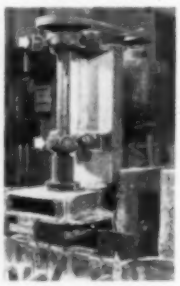
Increase Minimum Bearing Life from 3 to 36 Months

Efficient design, long life and customer satisfaction may depend on solving a high temperature lubricating problem. Here's how such a problem in metal tempering furnaces made by A. F. Holden Co. of Detroit was solved with Dow Corning 44 Grease.

Molten salt is used as the heat transfer medium in Holden's metal tempering furnaces. Maintained at temperatures from 300 to 700 F, the molten salt is circulated by a pump submerged in the bath. The vertical shaft pump is driven by an electric motor located above the bath.

The efficiency of this design was originally discounted, however, by higher maintenance costs due to the melting of even the best organic greases and failure of the journal bearings supporting the pump shaft after as little as 3 months of service. Each bearing failure resulted in three or four hours of downtime and lost production.

Three and one-half years ago, Holden started using Dow Corning 44 Grease. There hasn't been a bearing failure reported since, and customer satisfaction is high. A tube of 44 Silicone Grease is now included with every furnace shipped. To assure its use, Holden has replaced conventional bearing fittings with grease cups. These cups are filled once every two weeks. They are given one complete turn each day.



Continuous performance is further assured by using electrical insulating materials made with Dow Corning silicones to protect the ¾ hp, 1250 rpm pump motor against the high ambient temperatures involved in mounting it close to the pump shaft. Holden's engineers figure that the additional insulating cost of about $12 is negligible compared with reliability and freedom from downtime and replacement costs. *No. 78*

Silicone Finish Adds Color and Life to Space Heaters

Many manufacturers of domestic space heaters have adopted silicone finishes. Available in a wide range of decorator colors, these heat resistant silicone finishes bridge the gap between organic finishes which rapidly lose their attractiveness at elevated temperatures, and more costly porcelain coatings. Here's a report received from one manufacturer of space heaters, the Quaker Mfg. Co. Division of the Florence Stove Co.

"There has been a trend in our design of heaters toward enhancing appearance by finishing certain functional parts in colors contrasting or blending with the greater portion of the cabinet.

"To do this, it has been necessary to use a finish which will be satisfactory in colors formerly considered impractical.

"Silicone paints were the answer to decorative color where high temperatures are involved. This is illustrated by the top grille on the unvented wall heater, the radiant door liners on the oil heaters, and the front grille on our Model 4210.

"Midland Industrial Finishes, a leading formulator of silicone-based paints and enamels, worked with Quaker in solving the finishing problem." *No. 79*

Design Edition 19

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EDITORIAL

Tackle the No-Show Problem

Failure to solve the no-show problem is still bleeding the airlines of critical revenue. About a year ago we editorialized on the gravity of this reservations system problem which saddles the airlines with empty seats and irritated customers.

During this year one segment of the airline industry, led by American Airlines president C. R. Smith and his sales vice president, C. R. Speers, has been campaigning for a uniform industry code to stop the no-show revenue leakage. To date nothing tangible has been accomplished, but Mr. Speers has recently been named chairman of the airline committee designated to tackle the problem, and there are signs that the bite of lost revenue is beginning to convince other major airlines that action is required.

Revenue Drain

Mr. Smith recently estimated that on a single airline in a single week more than 20,000 customers who held firm reservations didn't show by the time their flights departed. The value of these 20,000 tickets was more than $600,000, and all of it was refundable under the present airline reservation system. During the recent Florida winter season, Eastern Air Lines and National suffered heavily from over-reservations and no-shows that left empty seats on flights that supposedly were solidly booked.

Airline figures for the first quarter of 1956 show that no-shows and late cancellations equalled 17.6% of the total passengers boarded. Total cost of the no-show to the airline industry runs to millions of dollars annually in lost revenue plus additional millions in potential business that is discouraged by the uncertainty of getting a seat.

The present reservation system encourages passengers to make multiple reservations but does not encourage them to cancel reservations they know they won't use. It has led to a black market in reservations on heavily booked runs and during holiday rushes. From conversations overheard around crowded airline terminals during heavy traffic days, we know this haphazard reservations policy is turning people who want to fly back to the railroads and other forms of surface transport.

'Probable' Not Enough

As Mr. Smith points out in his recent discussion of the no-show problem in The Analysts Journal:

"There is a growing impression that the airlines do not know how to operate their business and there is a lack of confidence in what airlines tell their customers about availability of travel space.

"The airlines, knowing that many of the reservations will never be used," he wrote "too often encourage a patron to go to the airport without a firm reservation on the basis that it is 'probable' that there will be space for him. The customer is entitled to better than 'probable' assurance when he wants to buy your product and it is unfair for the airlines to saddle on the customer the lack of certainty that comes from a lack of good reservations policy."

As we pointed out a year ago, the European airlines have solved their no-show problem with a penalty charge for customers who do not cancel their reservations within a reasonable time before flight departure. This obviously will pose some problems for airline bookkeeping, but the net gain in revenue from a firm no-show policy would appear to far outweigh these problems.

We have been puzzled as to why air-traffic-conference attempts to solve this problem during the past year have been so fruitless. Mr. Smith says one of the main reasons is that it has received too little attention from the top executives in the airline industry. He charges they have been too willing to leave this vital problem in the hands of lower-level traffic technicians who have become too immersed in how to administrate a policy to effectively formulate one.

Executives' Attention

It does not seem unreasonable to expect top-level airline executives to devote some attention to one of the most pressing current problems of their industry. Certainly the jet transports they have been ordering in profusion will never have their capacious cabins filled by a reservations system that often requires a 15-minute delay on the telephone and still staggers along with the no-show problems.

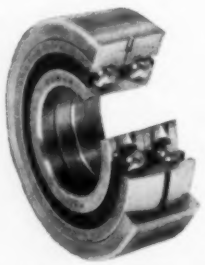
The air traffic control problem showed a similar trend to drift until airline presidents became interested in the economic penalties it imposed and supported the efforts of their chief pilots and operations vice presidents. Mr. Smith believes the no-show problems must be solved uniformly for the entire industry rather than by individual airline action because:

- **For competitive reasons** it would be difficult for one airline operating over a route to enforce a no-show penalty system while others didn't.
- **The customer is entitled** to reasonable uniformity of rules among the airlines.
- **A high percentage** of airline traffic involves interchanges where the customer uses more than one airline on a single trip. Interchange accounting between airlines would be impossible without a reasonable uniformity of no-show penalty procedures.

The Air Traffic Conference will meet again early next month in Minneapolis. Tackling a sound solution to the no-show problem should be high on its agenda.

—Robert Hotz

After all! Fafnir man or not, you should relax occasionally!



Fafnir Super-Precision Ball Bearing for main rotor shafts of jet engines.

Close contacts with the aircraft industry stimulate more than casual interest in its rapidly-advancing developments. Through nearly thirty years of collaboration, Fafnir Bearing Specialists have absorbed some of the spirit responsible for aviation's progress. A case at point is the development of the Fafnir Jet Engine Ball Bearing. This frequently-called masterpiece in bearing design and construction involves a radial and a thrust bearing assembled in a one-piece self-aligning outer ring. The Fafnir Bearing Company, New Britain, Connecticut.

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FIRST — at the turning points in aircraft design

WHO'S WHERE

In the Front Office

Brig. Gen. Lance Call, (USAF, ret.), vice president, Kellett Aircraft Corp., with offices in Washington, D. C.

Lt. Gen. Laurence C. Craigie, (USAF, ret.), vice president-engineering, Hydro-Aire, Inc., Burbank, Calif.

Henry W. Harding, president, Laboratory for Electronics, Inc., Boston, Mass.

R. Allen Price, vice president-sales and service, Stanley Aviation Corp., Denver, Colo.

Roderic M. Scott, vice president, Engineering & Optical Division, Perkin-Elmer Corp., Norwalk, Conn.

Lloyd L. Kelly, vice president-sales, Link Aviation, Inc., Binghamton, N. Y.

W. M. Chamard, vice president-contracts and consumer products, Canadian Aviation Electronics, St. Laurent, P. Q.

Retired

Maj. Gen. Samuel R. Harris, Jr., commander of USAF's Arnold Engineering Development Center, Tullahoma, Tenn., will retire July 31, after more than 30 years of active service. He has been AEDC commander since early 1953.

Honors and Elections

Wendell E. Reed, Solar Aircraft Co., project engineer and inventor of the Microjet control for engines, will be awarded the Wright Brothers Medal by the Society of Automotive Engineers Apr. 10th for his paper, "A New Approach to Turbojet and Ramjet Engine Control."

Herbert K. Weiss, chief of Northrop Aircraft's Weapons Analysis Department, has been reappointed for the third year to the National Technical Advisory Panel on Ordnance of the Department of Defense.

Changes

Walter Koch, engineering staff, Aerophysics Development Corp., Santa Monica, Calif.

John E. McBrian, senior project engineer, electronics development, North Electric Co., Galion, Ohio.

P. G. Beasley, sales planning manager, Central African Airways.

Robert L. Nuber, director, Washington State Department of Aeronautics.

J. W. Fedor, general sales manager, Breeze Corporations, Inc., Union, N. J.

P. H. Bremer, chief structural engineer, Lockheed Aircraft Corp., Marietta, Ga. Also: **J. A. Dilworth,** structural requirements division engineer and **John Boshar,** loads and dynamics department engineer.

Jack Morris, maintenance superintendent, Riddle Airlines.

Fred Meek, administrative engineer, Kellett Aircraft Corp., Camden, N. J.

Harold H. Warden, commercial sales manager, Link Aviation, Inc., Binghamton, N. Y.

David A. Highman, staff manager-commercial and military airfreight sales, American Airlines.

INDUSTRY OBSERVER

► Cornell Aeronautical Laboratory has an Army project for development of an anti-missile missile.

► **Convair F-102A has been flying experimentally with an enlarged tail fin to get greater stability at high speeds. Additional fin area has been fitted like a glove over original tail. Later models of the F-102 will be fitted with the larger fin. Convair also has modified the canopy design of the TF-102 trainer to eliminate buffeting just below Mach 1.**

► USAF is still wrestling with the problem of toxic effects of cabin pressurized air bled from jet engine compressors.

► **One of the big factors pulling against a Rolls-Royce Tyne powered version of the Lockheed Electra transport is the price Rolls is quoting airline customers on its turboprop. Current price of production version Tynes is about $115,000 compared to $86,000 for Allison T56 purchased by U. S. airlines for their Electras.**

► Vertol Aircraft Corp. has built prototype of H-21 helicopter rotor blade with boundary layer control. It is at Wright Air Development Center for whirls and test.

► **Lear, Inc., will build a branch plant at Cointrin Airport, Geneva, Switzerland, for the manufacture of automatic pilots and other aircraft instruments for European customers. The Geneva local government has placed a large hangar at Lear's disposal.**

► McDonnell Aircraft has built 31 F-101 Voodoo test and preproduction fighters. First production F-101A is expected to come off the firm's St. Louis, Mo., line in June.

► **Automatic oxygen system to sustain jet transport passengers in event of cabin pressure loss has been developed by Scott Aviation Corp., Lancaster, N. Y. As planned for the Douglas DC-8, the system, triggered open by the pressure loss, would drop oxygen masks in front of each passenger's face from overhead compartments. Oxygen lines throughout the cabin would be filled simultaneously from a central system. Tension required to put the mask on face would open a valve, providing oxygen in individual face pieces.**

► Boeing plans to evaluate an Atkins stroboscopic anti-collision light (AW Oct. 3, p. 78) on its 707 jet transport prototype. New unit is especially designed for high-speed operation and has a fineness ratio of 6:1 to minimize drag. Measuring 2.5-in. high by 5.5-in. wide by 30-in. long, it weighs approximately four pounds and requires no skin cutouts except for six small screw attachments. Nine Atkins lights are now flying, including installations on both USAF Boeing YC-97 turboprop powered transports.

► **Fairchild Aircraft Division has proposed a new assault transport to USAF, featuring the J44 engine, a wider landing gear than that carried by the C-123B and a fuselage built at truck-bed height. Designation is the C-219.**

► Navy has ordered $45 million in additional production of the Chance Vought F8U-1 Crusader jet fighter. This is in addition to initial order of $100 million announced last December. Crusader is in production at the Dallas plant.

► **Joint Chiefs of Staff are making a careful study of the Army's six-year plan for a continued build-up of Army aviation. The plan, written by Maj. Gen. Hamilton H. Howze, chief of the Army Aviation Division, provides for 4,000 to 5,000 aircraft by its completion. Army Chief of Staff Gen. Maxwell Taylor calls the plan "vital to the future of the Army," insists it does not conflict with Air Force plans.**

► Swissair officials say the two DC-8s they have ordered probably will be fitted with Rolls-Royce Conway engines.

"Outstandingly reliable"

"Passenger Acceptance... Overwhelming"

"A Money-Maker"

... say leading airlines of the Viscount

TRANS-CANADA AIR LINES. J. T. Dyment, Director of Engineering: "Every department in the Company is most enthusiastic over the results being achieved with the Viscount. From an economic standpoint, the Company feels it has had enough experience already to be confident that *it has a money-maker in the Viscount.*"

CAPITAL AIRLINES. J. H. Carmichael, Pres.: "The passenger acceptance of the Viscount has been overwhelmingly favorable and its *operating performance outstanding.*"

TRANS-AUSTRALIA AIRLINES. E. F. Coate: "With an average of less than one year in service, TAA's five Viscounts carried 230,000 passengers on 6,263 flights with an average load factor of over 85%. They did this with a regularity such as to point to the Viscounts as *one of the most outstandingly reliable aircraft of our time.*"

Such tributes, based on actual airline experience, are most eloquent testimony to the superiority of the Viscount, the world's first and only turbo-prop airliner in service. It has the greatest passenger appeal of any plane of modern times and has proved itself in operation to be one of the most economical and profitable aircraft ever built.

United States Representative: Christopher Clarkson, 10 Rockefeller Plaza, New York 20, N. Y.

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Washington Roundup

Salaries, Bonuses, Options

One more indication of the widespread Congressional interest in aircraft profits and salaries is last week's report by the Senate Preparedness Investigating Subcommittee, headed by Sen. Lyndon Johnson (D.-Tex.). It lists the salaries, bonuses, and stock options of all of the officers of 20 airframe and engine manufacturers from 1949 through 1955. It does not disclose names. The data overlaps with the information that has been developed over the past month at public hearings before the House Armed Services Investigating Subcommittee headed by Rep. Edward Hebert (D.-La.).

Last fall, the Preparedness Subcommittee issued a report covering the profits of aircraft manufacturers, both as percentage of sales and percentage of net worth, for 1943 through 1954 (AW Sept. 19, p. 16).

CAA-USAF Agreement

Civil Aeronautics Administration's delegation of various statutory responsibilities to the military, over the objections of industry, has been one of the first problems taken under study by Edward P. Curtis, Special Assistant to the President for Aviation Facilities Planning.

Curtis is now looking into a four-month old agreement between CAA and USAF Air Defense Command whereby certain of CAA's responsibilities for air traffic control separation of IFR traffic have been turned over to ADC.

Industry has no complaint against CAA's relinquishing authority for safe separation of traffic to ADC units when military flights are on active defense mission. However, objections have been raised on the so-called Fighter/Interceptor Agreement signed last Dec. 1 by USAF Gen. Earl Partridge and former CAA Administrator Fred B. Lee. Two points that have been challenged are:

- **The agreement** was handled secretly without concurrence of all parties involved.
- **It is an expansion** of previous agreements to include fighter/interceptor exercises and training missions.

Air Power Hearings

The Senate Armed Services Subcommittee set up to evaluate the status of the aircraft and guided missiles programs, headed by Sen. Stuart Symington (D.-Mo.), now plans to start off with open hearings next week, after the Congressional recess. The subcommittee is scheduled to complete its investigation by July 1.

Furnas and Newbury

Evidence continues to pile up that Frank D. Newbury, Assistant Secretary of Defense for Applications Engineering, would like to see research divorced from development of weapon systems. Despite Defense Secretary Charles E. Wilson's denial that his short-lived memorandum of Feb. 21 was designed to cut job of Dr. Clifford C. Furnas, Assistant Defense Secretary for R & D, in half by handing development over to Newbury, House Appropriations Committee heard testimony hinting that the contrary was true. On Feb. 23, two days after the memo was issued, Dr. Furnas gave the committee his opinion that the old division—keeping R & D together, but separate from procurement—is satisfactory. Newbury differed. He said it would be logical to have three classes of activity: research, development and procurement. Furnas' bailiwick of R & D was labeled by Newbury as "apples and oranges mixed together."

Pentagon observers in R & D circles feel Newbury, aided by W. J. McNeil, Defense Comptroller, made strong bid to take over the oranges, was frustrated by Furnas' threat to quit.

Civil Aviation Medicine

Legislation expanding the activities of Civil Aeronautics Administration in the field of aviation medicine is being pushed by Rep. Percy Priest (D.-Tenn.), chairman of the House Commerce Committee. The measure would establish an Office of Aviation Medicine, headed by a Civil Air Surgeon. Within the office would be a Civil Aeronautics Medical Research Laboratory.

"For a long time there has been a growing feeling that perhaps civil aviation medicine has not had the federal support needed for it to keep pace with aeronautical and engineering progress," Priest said. "Civil aviation medicine should keep abreast of new technical improvements in the design and operation of aircraft. Despite the mushroom-like growth of aviation during the past three decades, our civilian pilots are being selected by physical standards which I am told have undergone but little change since they were originally promulgated in 1928. Except for sporadic projects there has been no research conducted to determine the human requirements in civil aviation."

Helicopter Problems

For long-confident helicopter designers and salesmen, the U. S. Marine Corps displays less than warm enthusiasm in testimony before the House Appropriations Committee. On rotary wings for assault operations, Navy Secretary Charles Thomas said limitations are imposed "because of technical difficulties, which have not reached the point where we can get the helicopters with the characteristics we need." And Gen. Randolph M. Pate, Marine Commandant, added: "Actually in the development of a tremendous helicopter I think they ran into a great many engineering problems they had not anticipated. The thing did not move along quite as well as it should, and there was engineering slippage. . . . I am afraid, sir, it is going to be a matter of years yet."

Although it was unnamed in the testimony, the helicopter under discussion is assumed by observers to be the Sikorsky twin-engine HR2S (S-56).

CAB Confirmations

Senate Commerce Committee has put off any consideration of confirmation of the nominations of G. Joseph Minetti and James R. Durfee to be members of the Civil Aeronautics Board and Charles J. Lowen to be Civil Aeronautics Administrator until after the Congressional recess, which ends Apr. 9. Durfee, who is slated to be CAB chairman, was nominated two weeks ago. But the Minetti and Lowen nominations have been sleeping in the Commerce Committee for almost three months.

—Washington staff.

Indecision, Not Funds, Bogs Missile Plan

Administration says problems stem from planning, but missile money is drawn from other programs.

By Claude Witze

Washington—USAF's effort to develop a ballistic missile ahead of the Soviet Union is now being stymied by poor organization and indecision rather than from the lack of funds that held up earlier progress. This was made clear last week with publication of the Defense Department's Fiscal 1957 budget testimony before the House Appropriations Committee.

At the same time, the department warned that the channeling of funds into the missile race has forced a curtailment in the development and procurement of manned aircraft.

This curtailment, the report said, would constitute a menace to the U. S. if any large-scale war should break out.

Both Administration officials and their critics generally agreed that, while the funds are now available, the missiles' program is hampered by new bottlenecks in its basic organization and delays brought on through indecision.

R & D Dispute

These points were made by witnesses:

• **USAF Secretary** Donald A. Quarles said there was no difference of opinion between his office and Trevor Gardner, recently-resigned Assistant Secretary of Air Force for Research and Development over funds for the ballistic missile program.

• **Gardner agreed** but maintained vehemently that the overall research budget is too small, by as much as $316 million, and that the total USAF budget "is billions of dollars short of what is needed to achieve supremacy over the Russians in airplanes as well as missiles."

• **Gen. Nathan F. Twining,** USAF Chief of Staff, recommended an additional $100 to $150 million for research and development "not applicable to the missiles business."

Gen. Twining joined Quarles in making it clear to the House group that the Fiscal 1958 budget will have to be larger for USAF to maintain its fighting strength at programmed levels.

High Missile Priority

It is clear from the testimony that the priority status of the ballistic missile program is high. The exact degree of priority appears lost in a semantic maze, including disagreement over definition of "crash" program.

Quarles, who believes that guided missiles might be a decisive factor in a war 10 years from now, made it clear that he opposes "crash" programs as such, but said that for all practical purposes he considers the missile work now is on that basis. His distinction is that "we used to have people tear their hair . . . and then we would go out excitedly and hope to get it early by doing a lot of foolish things. In all my experience, that never produced anything useful early."

Gardner said "crash" implies that there is a big risk of failure and that by his definition, USAF's ballistic missile program is not on a crash basis. "However," he said, "by more conservative people's definition of crash they are over-crashed."

Dr. Clifford C. Furnas, Assistant Secretary of Defense for Research and Development, said that the missile program, particularly under Murphree, "will be essentially a crash program. It is a crash program and this is an organizational change."

Gardner suggested addition of the $316 million to USAF's budget of $610 million in a letter to Quarles, dated last Jan. 16. To support this case, Gardner disclosed, he had the paper signed by Gen. Twining; Assistant USAF Secretary Lyle S. Garlock; Lt. Gen. Donald Putt, Deputy Chief of Staff for Development; Lt. Gen. Frank F. Everest, Deputy Chief of Staff for Operations; Lt. Gen. James Doolittle, chairman of USAF's Scientific Advisory Board and Dr. Guyford Stever, Chief Scientist of the Air Force.

Gardner said Quarles' reply to his memorandum brought about his split with the Defense Department. He said Quarles argued, for example, that USAF should be more selective in what it tried to do. Gardner replied with figures showing that in 1956 the program puts 29% of the contractual funds into five projects. Over 50% of the funds are concentrated in 17 projects, less than 4% of the total number.

Gardner said his basic philosophy includes taking "the big chance." And the Quarles approach, which he traced to the Secretary's experience with Bell Laboratories, is "that of developing, step by step, and taking each step as the previous step is proven."

Missiles vs. Aircraft

The missile program, Gardner said, "has not been fund-limited within the Air Force or within the Department of Defense. (The secretaries) have supported it with all the funds that we needed. Unfortunately those funds all came out of other funds and has had the net result of reducing our airplane program. It was this unpalatable price—some of the funds had come out of continental defense—that was one of my objections."

"I felt we should fund the program separately and it should not take funds away from our badly needed development of bombers, fighters and various other missiles," Gardner told the committee.

"With our existing fighters, which are working extremely well,—the 104,

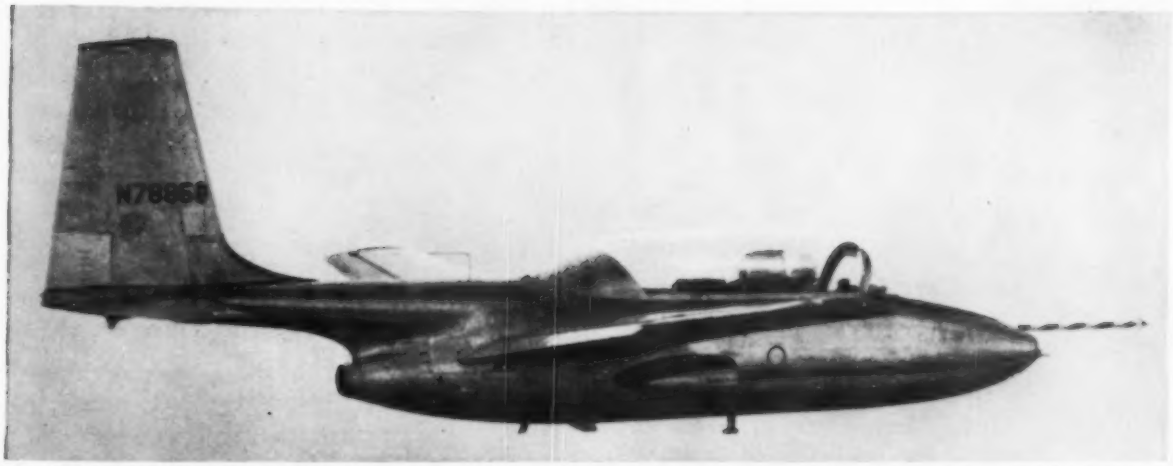
Missile 'Czar' Named

Washington—Eger V. Murphree has been named to direct and co-ordinate guided missile activities in the Defense Department. As a Special Assistant to Defense Secretary Charles E. Wilson or "czar" of missile projects, he will be responsible for research, development, engineering and production of new missile projects with major emphasis on long-range ballistic weapons.

Murphree, 57, has been president of Esso Research and Engineering Co. since 1947. He will serve without compensation and report directly to Wilson. During World War II he was a member of the Office of Scientific Research and Development S-1 Committee, which helped set up the Manhattan Project. Earlier, he was chairman of the planning board that made it possible to get raw materials and pilot plants for the early stages of A-bomb development.

A graduate of the University of Kentucky, Murphree has been on the staff at Massachusetts Institute of Technology. A chemical engineer, expert in petroleum research, he has been employed by Solvay Process Co., Standard Oil and Hydro Engineering and Chemical Co.

Secretary Wilson said Murphree will stay on the job at least a year with whatever authority he needs. It was not clear how the new "czar" will arbitrate differences between the services, although when the post was created he was made chairman of the Ballistic Missiles Committee and top contact man for Wilson in work with all assistant secretaries. Wilson said last week "if he gets into a jam . . . I'll be in it with him."



POD-AND-BOOM FUSELAGE, large tail, characterize Temco 51 primary jet trainer designed for U. S. and foreign military services.

the 101 and the 105, to be very specific—we are embarked upon, because of the funds limitation, a very cautious program of procuring these aircraft. In general, we are applying the fly-before-you-buy philosophy.

"There again this is partly for lack of funds which are flowing into the ballistic missile program."

Wilson Rapped

In 1,236 printed pages of testimony, roughest treatment was meted out to Secretary Wilson. Committee Chairman Clarence Cannon (D.-Mo.) and Rep. Jamie L. Whitten (D.-Miss.), accused Wilson of seeking to withhold information and treating his questioners lightly.

At one point Rep. Cannon tried repeatedly to get Wilson to estimate relative aircraft production rates between the U. S. and Russia. Despite Wilson's protest that he was not being "devious," Rep. Cannon exclaimed:

"It seems to be absolutely impossible to get any information out of you. You are up here to give us some information. You are asking for the largest sum of money ever asked and you are not telling us what the reason is why we should spend it."

Wilson said later that much of the information Rep. Cannon sought was classified and should be given by the Air Force Chief of Staff at an off-the-record session.

Rep. Whitten cited the case of a Congressional committee's report on procurement which cited lack of cooperation on the part of the military. The report, Rep. Whitten said, came back to his committee marked "secret" by the military department. He suggested that sensitive references could be deleted and the report made public.

In the subsequent exchange, Wilson suggested: "Maybe one of the magazines would pay you some money for an article."

The committee record also discloses a letter of apology sent to the chairman on Feb. 13 by Gen. Thomas D. White, USAF Vice Chief of Staff. The letter followed an address given by the general four days earlier in Cincinnati (AW Feb. 20, p. 31).

In his speech, Gen. White made a statement, seized upon by Rep. Errett P. Scrivner (R.-Kan.) that "the taxpayer and the legislator quite understandably prefer to see our national income spent on success, not failure. This makes the research and development dollar hard to get."

Rep. Scrivner, holding that the committee is a "pushover" for R & D requests, obtained from Gen. Twining a statement that his top assistant had made an "unfortunate interpretation."

R & D Funds

(In millions of dollars.)

FY	Missiles	Aircraft
1950	106.9	125.5
1951	185.0	209.5
1952	308.6	245.4
1953	350.4	239.9
1954	220.8	237.1
1955	212.1	250.5
1956	231.3	270.3
1957	199.0	253.7

(Because there have been two major Department of Defense budget structure changes within research and development appropriations in the years covered, these are the only available amounts affording a comparison. They are within 10% of the budget structure amounts. They do not include funds for advanced development models and test quantities of aircraft and missiles. Source—Assistant Secretary Defense (R&D) Technical Coordinating Committee.)

Temco Introduces Primary Jet Trainer

Temco Aircraft Corp. last week started an extensive flight test program on a new single-jet primary trainer that will vie with the Beech 73 as a replacement for piston-engine trainers used by U.S. and foreign military services.

The new Temco 51 is similar in size and weight to the Beech 73 (see page 69). Maximum speed approximately 50 mph. higher than the 295 mph. of its competitor is claimed. Both aircraft use the Continental YJ69-T-9 of 920 lb. thrust.

To ease maintenance, a specially designed engine dolly can be used as a work-stand. The turbojet can be exposed for routine checks in 10 seconds and a complete engine change can be made in 20 minutes, including time to start the replacement engine.

Dimensions of the new trainer: Wingspan, 29.83 ft.; overall length, 30.6 ft. Wing area is 150 sq. ft. Normal gross weight is 4,137 lb. Normal fuel capacity is 119 gal., providing 1.5 hours endurance at sea level. A total of 156 gal. can be carried utilizing bladder-type fuel cells in the leading edges of the wings' center sections and outer wing panels.

Maximum level flight speed is stated to be 345 mph. at 15,000 ft. and 327.7 mph. at sea level. Cruise speed is 247.2 mph. at 25,000 ft. Service ceiling is reported as 35,000 ft. Maximum dive speed is 575 mph. The airplane's ultimate load factor of 11.25 Gs. The Temco 51 climbs at 1,900 fpm.

At take off gross weight the trainer's stall speed with landing gear and flaps down is 75.9 mph.; in the same configuration at normal landing weight, stall speed is given as 66.3 mph.

Tupolev 104: Harsh Proof of Rapid Soviet

London—Appearance of Aeroflot's Tupolev 104 jet airliner (AW Mar. 26, p. 29) presented new evidence of the remarkable advances in aircraft design made by Russia during the last few years.

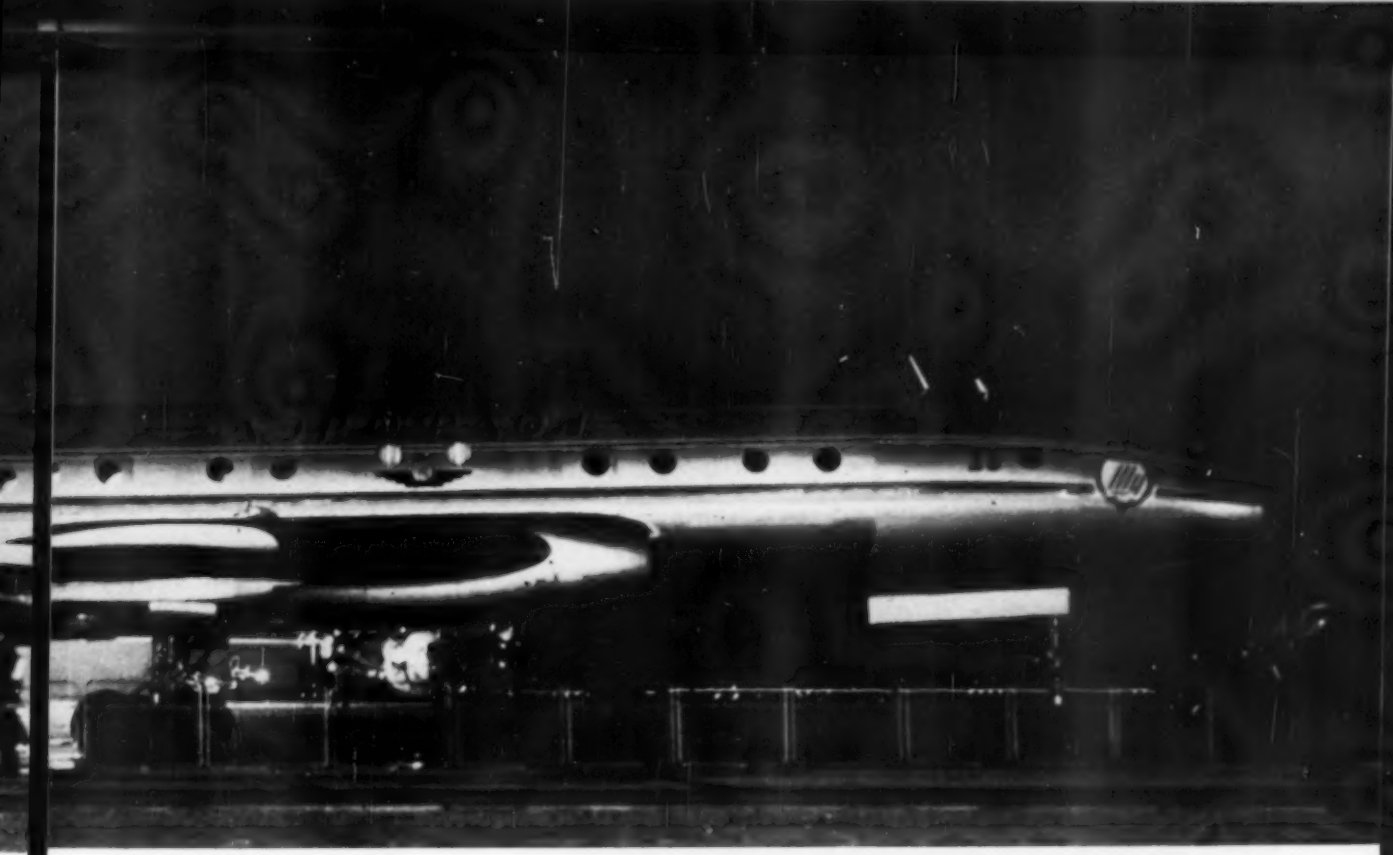
The twin-jet aircraft shows sound design characteristics built into a contemporary airframe powered by two of the largest turbojet engines operating in the world today.

Designer Andrei N. Tupolev writing in Pravda last week said his airplane was in quantity production and described it as having a 2,000-mile range, cruising altitude of 33,000 ft. and cruising speed of 500 mph. Single engine ceiling is 16,000 ft., according to Tupolev. Marshal Zhavoronkov, head of Aeroflot, said the Tu-104 will be used on the Moscow-Peking route and routes connecting Moscow with several European capitols.

(Aeroflot has rights to land in Stockholm and Helsinki. Negotiations with France were discontinued some weeks ago because the Russians wanted to delay operations to Paris until they could exploit their latest equipment, presumably the Tu-104. French sources anticipate no political problems in allowing Aeroflot to serve Paris, but they note that technical difficulties are present—a language problem for one and Aeroflot conformation to the codes and practices of the ICAO regulations for another.)

The aircraft carries two pilots, navigator, flight engineer, radio operator and stewardess. Tourist configuration will carry 70 passengers, according to Aeroflot.

Most observers believe the Tupolev design owes many features to the standard Russian medium jet bomber, the Badger, believed to be an Ilyushin design. Particular points of similarity include the tail, landing gear and nose. The engines appear to be mounted fur-



Progress

ther outboard on the jet liner than on the Badger.

Most impressive feature of the new aircraft is the apparent size and thrust of the engines. Rolls-Royce designers calculated the diameter of the huge air intakes as 40 in. and estimated the thrust of the engines at 15,000 to 17,000 lb. Other qualified observers made estimates from 12,000 to 20,000 lb.

These engines probably are the same as those used in the Badger and Bison bombers, which have been estimated to have a thrust approaching 20,000 lb.

The exhaust nozzle diameter is calculated at three feet. Overall length of the engine nacelle is approximately 40 ft. and maximum diameter is five ft. The engine inlet itself probably is half way back in the nacelle near the wing front spar. The thrust line is angled outboard to protect the fuselage from blast.

Noise level of the Tupolev upon its takeoff to return to Moscow was comparable to the de Havilland Comet I.

Prior to landing on the inbound flight and then upon taxiing to the ramp, the engines seemed unusually quiet in view of their size, although there was no indication of silencers.

Length of the cigar-shaped fuselage is about 120 ft. Span of the thick, swept wings is approximately 118 ft. Sweep is more than 30 degrees. Height of the vertical tail fin is about 33 ft.

Two wing fences are evenly spaced outboard of the landing gear nacelles.

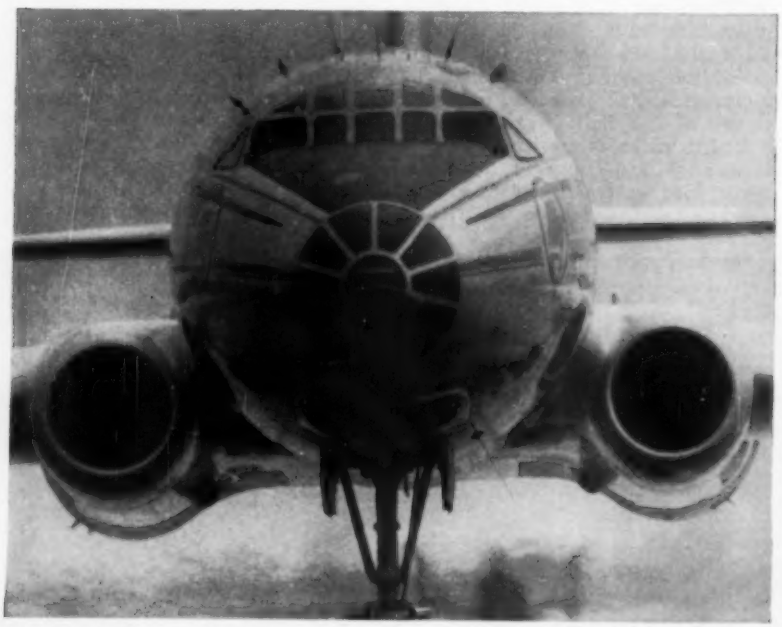
The four-wheel, double-truck landing gear tucks into separate nacelles outboard of the engines. The nose gear is a steerable twin-wheel.

Fuel is stored in the wings and the lower part of the fuselage. Some 8,000 Imperial gallons (9,600 U. S. gals.) of jet fuel were taken aboard after the three-and-one-half hour, 1,564-mi. flight from Moscow.

The plane assigned to Gen. Ivan A. Serov, Russian security chief, for the trip to London has a 52-passenger seating arrangement, according to Russian sources. It is finished with pale blue seats and inlaid walnut panelling. There

TUPOLEV 104 dwarfs assembled crowd after its landing at London Airport. Lone entrance to the jet transport is at left rear.

SEPARATE WING NACELLES house main landing gear; wheels have a 42-in. diameter.



NOSE VIEW shows compact size and simplicity of air intakes for Tupolev's 20,000-lb. thrust turbojet engines. Note the large number of antennas above and below cockpit.

are 15 small round windows, a little more than one ft. in diameter, down the starboard side. Four of the windows are set into square escape hatches. A single door is aft on the port side.

Below and behind the bomber-styled nose is a bulging radome, presumably for navigational radar. Radio antennas and masts appear conventional.

Control surfaces seem standard with servo tabs and a non-flying tail. Thick leading edge of the wing and blunt nose would seem to place the aircraft in the 500-mph. class, certainly not much above. This seemed to be confirmed by the time en route from Moscow.

Civil Markings

The jet liner carried the markings of Aeroflot, the Russian civil airline. There was a blue stripe the length of the silver fuselage, a red flag on the tail, and a red hammer-and-sickle insignia below one of the escape hatchs. Stylized Russian script "Tu"—for Tupolev—is on the nose. The paint did not appear new and the aircraft gave evidence of having a considerable number of flying hours behind it.

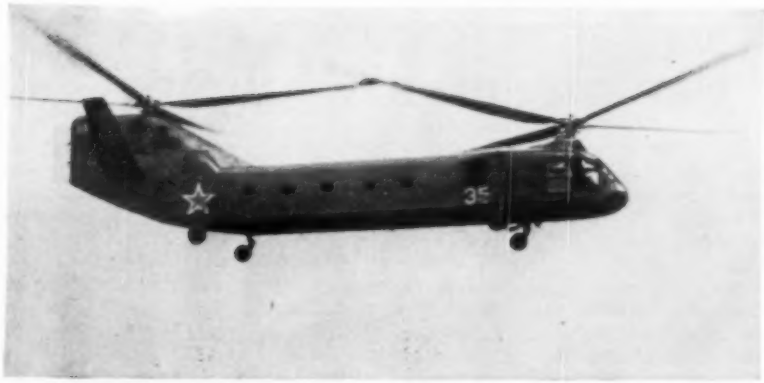
The Russian jet liner landed at London airport after a three-and-one-half hour flight from Moscow. Average speed was 446 mph. over the 1,564-mi. route.

A British assistant air attache, Squadron Leader J. J. Deverill, was aboard the aircraft to interpret air traffic control procedure for the Russian crew. He reported the airliner flew at 33,000 ft. for the trip. British weather service reported winds varying from 20 mph. due north to 80 mph. due south over the route.

Slow Approach

Deverill said, "She flies beautifully," but refused to make any further public comment. He reported immediately to Air Ministry officials for interrogation after arrival.

The Tu-104 let down through the rain clouds over the airport and made



Russia Claims New Helicopter Records

A "Flying Van" helicopter designed by Yakovlev has reportedly established two Russian records for altitude with a fixed payload. The marks have been submitted to International Aeronautical Federation for confirmation as world's records. The twin-rotor helicopter, code-named the Horse, carried two tons (presumably the metric tons of 2,200 lb.) to 16,650 ft. and four tons to more than 6,560 ft. Official identification of the designer as Yakovlev settles a long-debated point among Western observers. First reports credited the design to Yakovlev, but later pictures showed that the rotor systems were the same as those used on a Mil design, and so the Horse was assumed to also have been developed by a team under the direction of Mikhail Mil.

one pass at the field at about 2,000 ft., then it circled and made a slow approach, dropping its large-span slotted flaps. Landing roll was extremely short, even allowing for the strong headwind of about 30 knots.

Upon Serov's return trip to Moscow —which was made ahead of the originally scheduled departure of the Tu-104 because of the unpopular reception accorded the security chief—the plane set a record for the run of 510 mph. average speed.

Photo Interpretation

An analysis of available photographs of the Tu-104 leads to some suppositions about the design and background of the plane.

Most obvious points of similarity between it and the Badger are in the nose of the fuselage, the vertical tail and the landing gear in separate nacelles.

It appears as though those assemblies from the Badger were used intact and that a passenger fuselage and a new set of wings were built around them. This is a reasonable assumption, considering the Russian engineering tendencies to pool technical features and to standardize on sub-assemblies as much as possible.

It also is entirely possible that the complete nose and cockpit assembly has been standardized for use on all large Red aircraft, whether military or civil. Available pictures of the Bison show that it also has the nose layout of the Tu-104 and Badger.

Photos indicate that the wing is cranked at the leading edge, like that of the Badger, but the almost abnormal thickness of the Tu-104 wing suggests that a new airfoil section has been chosen for high-lift characteristics at the low-speed end of the flight regime in order to make the plane more docile in the landing pattern.

The argument between observers as to whether the Tu-104 is a Badger development or not and as to whether Tupolev designed the Badger are no nearer settlement than they were before the plane came into London, since there has been no comparable opportunity for western observers to examine a Badger.

Rated Thrust

Some conclusions about the thrust of the engines may be drawn from the knowledge of the amount of fuel—9,600 U. S. gallons—taken on board at London. If the cruise consumption of the engine is about 0.7 lb./lb./hr.—a figure representative of current designs—then the cruise thrust at 33,000 ft. altitude is about 13,000 lb. per engine. But at the Tu-104's cruise conditions, the engines would be delivering approximately 60% of their sea level static thrust.

Therefore, the engines must be rated at approximately 20,000 lb. static thrust at sea level.

This checks earlier estimates of the power of Badger and Bison engines made in this country and the U. S. by powerplant experts.

Said one British engineer, "I reckon these (Badger) engines to deliver about 22,000 lb., based on our estimates of the tailpipe diameter. Also, we know the Russians to be logical chaps who would use nice round figures for design thrusts. And 22,000 lb. is 10,000 kilograms."

The general attitude of Western observers is that the engines are very high-powered, and any attempt to depreciate their thrust to the 12,000-lb. level is wishful thinking.

Fuselage Design

Fuselage of the Tu-104 is circular in cross-section and approximately 12 ft. in diameter. The Badger's fuselage is elliptical, much narrower and somewhat shallower.

The window line is broken in the plane of the engines by a slight step up for a pair of windows over the wing. This suggests one of two things: either the lavoratories are located there, because of the possible danger from a compressor failure, or there may be berths placed above the wing carry-through structure.

Soviet Navy Threat To Atlantic Sea Lanes

New York—Russia's Navy has the capability of attacking Atlantic shipping from the air "on a scale and intensity out of comparison with anything experienced in the broad oceans in the past," the intelligence officer for the Supreme Allied Commander Atlantic said last week.

If war should break out, the Russian navy now has six times the air strength available to Nazi Germany in 1939 with which to attack the sea lanes linking North America with western Europe; seven times the submarine strength, and three times the heavy surface fleet.

These estimates were made by U. S. Admiral Jerauld Wright, commander of the North Atlantic Treaty Organization naval command, and his staff at an Overseas Press Club meeting.

Besides increased numerical strength, the Russians have converted all navy fighter and light bomber units to jet aircraft. The NATO command expects the Soviet to soon outfit its submarines with guided missiles with nuclear warheads, posing an additional threat to ports and coastal region cities on both sides of the Atlantic.

There is no indication that the Russians have aircraft carriers. The reason cited for this is that none are required for their basic mission. Russia is not dependent on sea lane communications and the consequent need for carrier forces to keep them clear.

Whereas, the Russian navy was obsolete and inexperienced in 1945, today it is large, expanding with new, surprisingly up-to-date equipment, some of it "extremely" advanced. "Their ships, submarines and aircraft train together, and we believe they are ready for war today . . . ," the intelligence officer said.

Profits Investigation:

USAF Defends Procurement Policies

By Katherine Johnsen

Washington—The Air Force firmly defended its policy of not allowing incentive bonus payments as government costs at closing sessions of House Armed Services Investigating Subcommittee hearings on military aircraft procurement.

The Navy has made no ruling against allowance of bonuses, and considers only the "reasonableness" of the total compensation of management. The aircraft industry has protested the USAF position. The matter is now up for decision by the Defense Department.

Deputy Assistant Secretary of the Air Force Max Golden told the subcommittee experience with aircraft manufacturers has been that "they start out on a very modest basis (with incentive compensation plans) but gradually expand." He said Boeing Airplane Co., started off with an incentive compensation plan of $180,000 a year and enlarged it in the next few years to $4 million.

The subcommittee has completed public testimony from the 12 major airframe concerns, the Air Force, Navy, and Renegotiation Board. The group is tentatively scheduled to begin a field investigation of West Coast plant facilities of the 12 firms on Apr. 20. Eastern facilities will be inspected later. No firm decision has been made as to public hearings on helicopter companies and aircraft engine companies. Whether or not hearings are held the subcommittee's report will cover these concerns as well as the 12 airframe manufacturers.

Other developments in the concluding hearings of the subcommittee, headed by Rep. Edward Hebert (D.-La.) were:

• **Assistant Secretary** of the Air Force Dudley Sharp urged against the setting of rigid formulas for cost and profit allowances on contracts. "Due to the great variety of the contracts and the great variety of situations . . . we would prefer to have a considerable area in which to operate," he said. "We should not have a definite formula laid down."

• **Seventy-six Air Force** aircraft and guided missile contracts have not yet been finalized, and of these one fourth are over six months old, it was reported.

• **Sharp testified** that delivery schedules set for aircraft production are "tight." "We make schedules reasonably ambitious because we are trying to get ahead in this game of developing and producing new airplanes," he explained, "but they are capable of achievement." (The House Military Appropriations Subcommittee has criticized that contract files show "one delivery date extension after another" and declared that the impression is gained that delivery is a relatively unimportant detail.")

• **Termination costs** on USAF's $100 million cutback in the F-84 program at Republic Aircraft Corp. is estimated at between $80 and $100 million. Most of the excess inventory acquired by the cancellation will be utilized for spares and parts in support of the F-84 program, according to USAF. Production of F-84s will run for another year and a half.

• **Subcommittee Counsel** John Courtney declared that the highest cost airframe manufacturer "also happens to be the company where the management receives the highest return for its services."

(The company which reported the highest management salary costs to the subcommittee was North American Aviation, Inc., with a cost of $993,250 for 1955.)

• **USAF now requires** approval of executive salaries by Air Materiel Command headquarters. Three guidelines established for determining "reasonableness" are: volume of the company's business; complexity of items being manufactured; the degree of private ownership.

• **Renegotiation Board** reported that it receives 10,000 cases annually, of which 3,000 are referred to field offices for investigation. Regional boards have authority to make final determinations on all cases involving $800,000 or less renegotiable business.

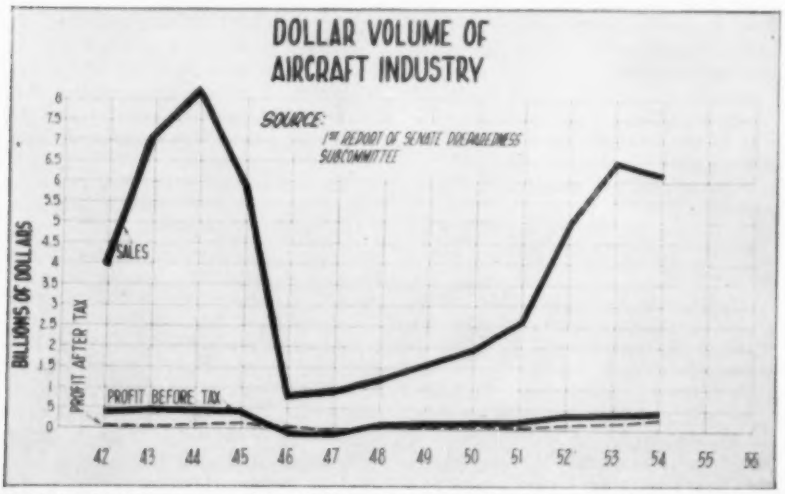
• **Thomas Coggeshall,** chairman of Renegotiation Board, recommended that other aircraft firms follow the example of McDonnell Aircraft Co. and set aside reserves to cover possible recaptures of profits in the renegotiation process.

"This is what most companies outside the airframe industry do who have substantial renegotiation business," Coggeshall said.

• **Executive salaries** in the aircraft industry through 1952 were conservative compared with other major manufacturing industries, Coggeshall said.

He added, however: "It seems that in the last two or three lush years, though, they have been trying to make up for lost time." He said "it seems . . . the incentive plans and increased salaries have grown like Topsy in 1953, 1954 and 1955."

• **Blame for the delay** in making final renegotiation determinations was tossed back to the industry by Coggeshall. He gave three examples: (1) "despite repeated requests for an ultimate compliance with the furnishing of essential data." Lockheed Aircraft Corp. revealed for the first time in March, 1955, that it had experienced an over-run of costs on its 1952 business of $59 million; (2) Douglas Aircraft Co. reported sales on its 1952 business of $449 million in September, 1953, but revised the figure to $478 million in November, 1955; (3) Boeing Airplane Co. reported sales of $757 million and profits of $49 million on its 1952 business in March, 1953, but revised the figures a year later to $737 million sales and $54.5 million profits.



ABOVE CHART was prepared by Air Force for presentation before the Hebert committee.

ELECTRONIC CONSOLES are heart of Missile Master System. Operators enter targets on tracking screens with photo-electric guns.

Martin, Army Unveil 'Missile Master'

By Evert Clark

Ft. Meade, Md.—The prototype of the Glenn L. Martin Co.'s electronic "Missile Master" last week became the nerve center of this area's anti-aircraft defense, ready to coordinate the fire of 88 Nike launchers guarding Baltimore and the nation's capital.

This forerunner of a new local defense system will replace two manually-operated control sites, substituting electronic circuits, computers and cathode ray display consoles for the telephone and plotting board.

The Army budget now before Congress calls for production and installation of Missile Masters to control more than 100 Nike sites ringing 13 major cities. Cost of the system and the total number to be installed are classified.

Missile Master is designed to provide nearly-automatic, almost-instantaneous location and identification of aircraft and optimum distribution of firepower from a number of widely-scattered batteries.

Essentially, the Missile Master is a miniature version of SAGE, the Air Force's electronic continental air defense system (AW Jan. 30, p. 46). It is designed to operate in conjunction with SAGE, or act independently, to:

- **Guard against** "overkills" of a target—two or more batteries firing at the same hostile aircraft.
- **Prevent the** overlooking of a second target because of over-concentration on the first—a problem that could arise in the event of a mass saturation raid.
- **Prevent mistaken** attacks on friendly aircraft in the heat of battle.

Missile Master is designed around the short-range Nike missile. But Army Signal Corps and Martin Co. spokesmen told reporters at a press demonstra-

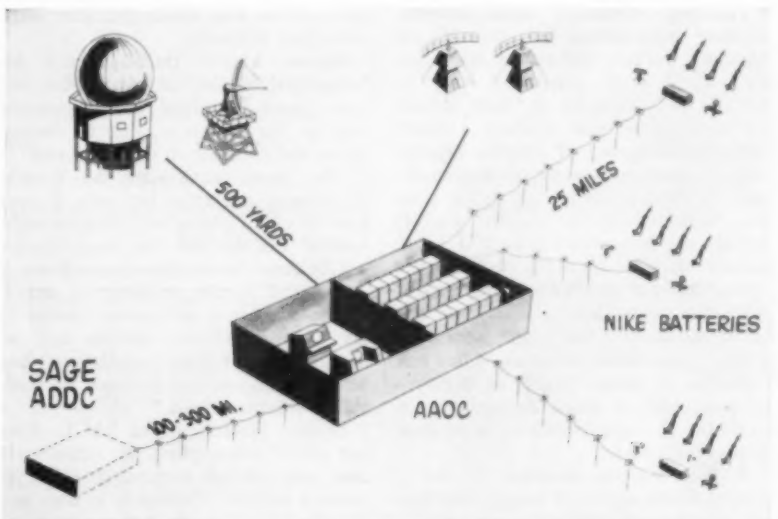


CHART depicts major elements of Missile Master system for the control of Nike batteries.

tion here that it "can be expanded" to coordinate the fire of "any current ground-to-air missile"—including the Talos, which the Air Force plans to install around some Strategic Air Command bases and other defense sites.

Begun in 1945

Development of this type system began in 1945 in the Radar Division of the Army Signal Corps' Electronic Laboratories at Ft. Monmouth, N. J. In 1950, a forerunner of the Missile Master was designed.

It was installed here and has been in experimental operation for almost two years. Martin is the principal contractor, and the Army said Martin has been aided by Airborne Instruments Laboratory and American Machine and Foundry. A Martin spokesman said there are "nine or 10 major subcontractors" but added only the names of Hoover Electronics of Baltimore and the General Electric Co.

Equipment for a mobile version is being developed, but the size of the radars required and the amount of equipment used would indicate that most sites in this country will be permanent ground installations. Whether they will be underground is classified.

The prototype installation is a windowless, two story cinderblock building, 160 by 190-ft. in size. Nearby, a huge surveillance radar revolves 10 times a minute inside a radome, and two height-finder radars nod rapidly on towers facing in opposite directions.

Inside is a darkened, high-ceilinged room filled with rows of radar-type consoles. It is called the Anti-Aircraft Operations Center (AAOC). At the front, two stock-market-type tote boards and two round projection screens present the whole air situation, including which batteries are engaged.

Key personnel in an AAOC will be:

• **Tracking operators,** who monitor warning information fed into Missile Master's tracking sub-system (by prefiled flight plan, radar and later by SAGE) and displayed on their scopes. Distinctively shaped markers indicate different categories of targets. Operators will make sure target positions indicated by SAGE correspond to the position indicated by local radar. Targets not already being tracked by SAGE are picked off the scope by photoelectric "guns" and fed into the tracking system.

• **Tactical controllers,** who monitor the air situation and the target selections made by individual batteries. They can intervene to assign targets to batteries to make sure of quick engagement or to terminate engagements to avoid duplication of effort.

Missile Master, therefore, is not a system which sights all targets and fires all missiles automatically—nor even a single control center from which all firing is done.

Pushing the button that launches the missile still is left to the battery commander. But the men and the machines in the Missile Master system have collected, processed and displayed (on scopes at his battery) the information he needs to select the proper target. If he errs, the tactical controller is ready and capable of overruling him.

• **The "friendly protector,"** who watches the positions of all known friendly aircraft and compares this with data returned from battery commanders. "At any time," the Army said, "this operator is provided with the necessary facilities for taking immediate action to halt the individual engagement of any friendly target." (Again, the battery commander can be overruled.)

Target Data Displayed

Critical elements of the Missile Master system are provided in duplicate, and Martin and the Army say that operations can continue with one or more major items inoperative.

In later models, the two projection screens will be replaced by two desk-type consoles, one for the tactical controller and one for the "protector." Each desk has a scope in the center and a panel at either side.

Targets are represented on the scope by three-digit numbers. Vector lines indicate speed and direction. A "dot code"—dots above, below and at each side of the three-digit number—gives the controller his target parameters at a glance, revealing size of the target mass, its altitude, its identity and whether it has been engaged.

The left hand panel, called the "Status Selector," allows the controller to select special target information by categories—all friendly aircraft at once, all hostile aircraft, all aircraft at the same altitude, etc. The right hand panel allows him to communicate with individual batteries.

Missile Master buildings will be "somewhat smaller" in later models and have about one-third the equipment used in the prototype, due to streamlining and elimination of duplication.

The Army anticipates no trouble in training operators but says it may have trouble training and keeping technicians. For the first year, maintenance will be done by civilians on contract.

No real estate problem is anticipated. An Army spokesman refused to say whether Missile Masters will be located right at Nike installations, but he said "full use will be made of available government land."

Missile Master, unlike SAGE, does not direct interception by aircraft. It does not control the missile after it leaves a battery. Ordinarily it does not directly control firing—but merely coordinates it—although it was indicated that all firing could be done from the AAOC if necessary.

Later systems operating with the SAGE system would feed information back to SAGE centers, as well as receive it.

Missile Master's effective range will not depend so much on the range of its radar, once it is tied into SAGE, but it will be limited by the effective range of whatever missile it directs.

Army Secretary Wilber M. Brucker, in announcing Missile Master, referred to it as "an electronic brain that detects enemy aircraft and missiles and controls and coordinates the fire of Army Nike missile batteries against such invaders."

In response to reporters' questions, the Army later said Secretary Brucker had "no intent to sensationalize the system" but simply to "state a fact previously published"—that Nike "has been fired successfully at missiles."

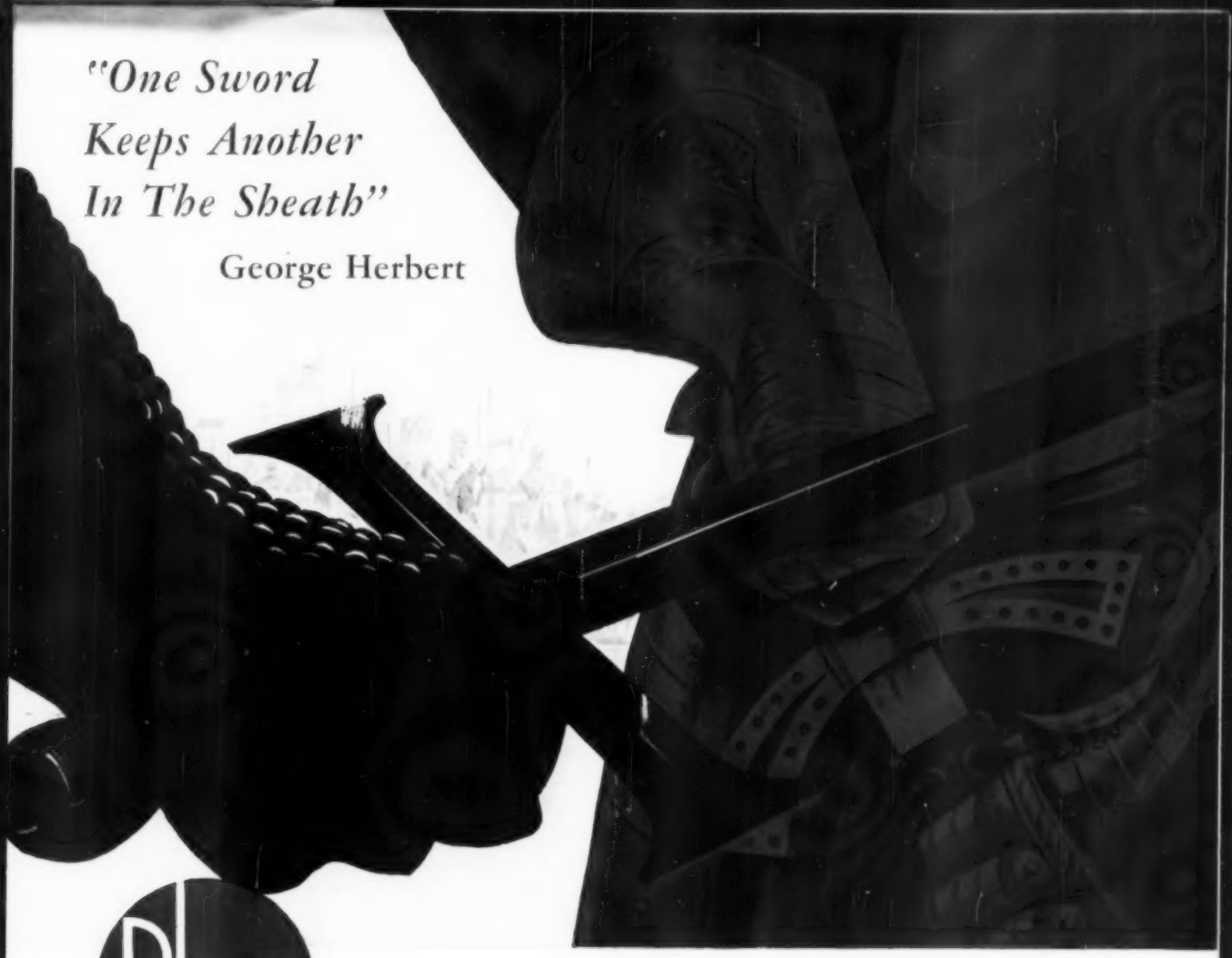
James C. Anthony

James C. Anthony, 52, New York district manager for Aviation Week, died of a heart attack last week in Myrtle Beach, S. C., while en route to his New York home from a Florida vacation.

A native of Philadelphia and graduate of the University of Pennsylvania, Jack, as he was known in the aviation industry, joined the Chicago office of McGraw-Hill Publishing Co. in 1942. He has been associated with the growth of Aviation Week since the magazine's inception in 1947 and was its first advertising sales manager.

Before joining McGraw-Hill, he was with Batten, Barton, Durstine & Osborn, Inc., and with Keeling & Co. and Sidenour, Vauk & Keeling, Inc., both of Indianapolis.

He is survived by his wife, Ann G. Anthony, and a son, James C. Anthony, Jr., of Roslyn, Long Island.



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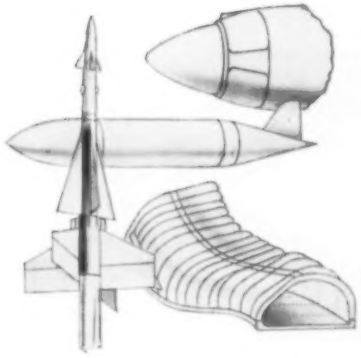

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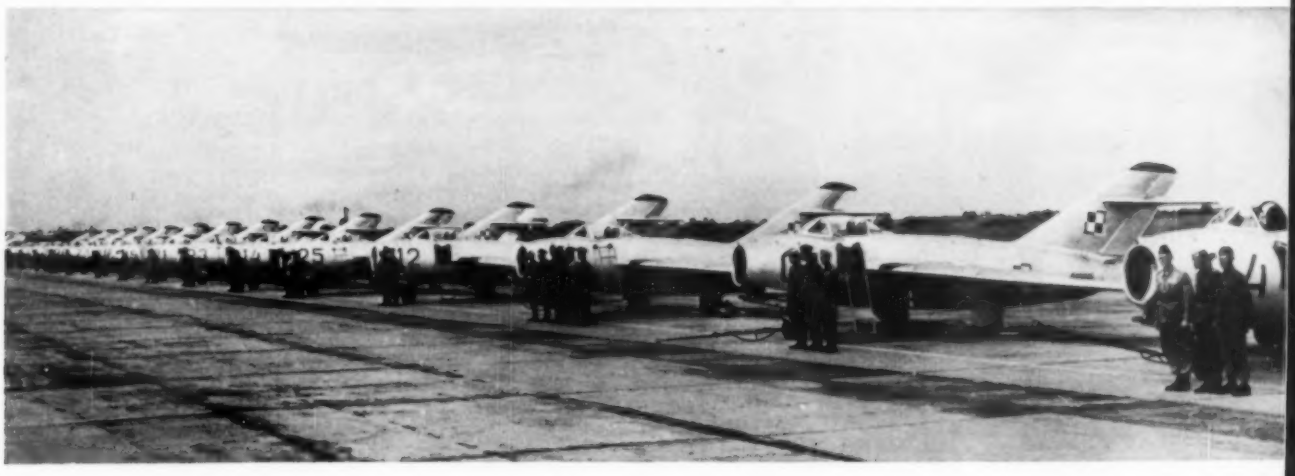
Polish Air Force Shows Its Wares

The Polish Air Force stepped out recently to play its part in the Communist version of Poland's "Liberation-Day." Greatest power was displayed by long line of Polish-built MiG-15 jet fighters (below), whose pilots wore the riding-breeches, cloth-hat garb of a bygone era. The three aircraft above are Russian-designed Tupolev Tu-2 attack bombers, which first appeared during the latter stages of World War II but are still front-line aircraft in the Polish and Chinese Communist air forces. The Tu-2s, powered by two 1,850 hp. engines, have a maximum speed of 360 mph. Aircraft at top right are Petlyakov PE-2 three-seat attack bombers. Also Russian-designed, the 340-mph. aircraft are now used primarily as crew trainers.



Airborne Mule Skinner for today's Defense

Now to the service of supply comes a new idea in military logistics—air transports that rival the train in ton-mile cost. Newest and largest, now on the way, is the turbo-prop Douglas C-133.

About to undergo flight tests, C-133 packs the load of *five freight cars* into its huge hull, loads 96% of military or construction equipment—fully assembled and ready for action—through an adjustable platform ramp in its tail section.

Speed and range are still secret but C-133's ability to shuttle back and forth across oceans gives it the cargo potential of a 7000-ton ship. Cost drops drastically because C-133 gets material into action in hours, rather than weeks or months.

Biggest cargo transport—the Douglas C-133A

Development of the Douglas C-133 shrinks supply lines and bolsters America's armed strength. But the core of that strength is the personnel manning posts and aircraft. Ask your local recruiting officer about the opportunities in the U. S. Air Force.

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Gen. Baker Reassures AMC Subcontractors

Detroit, Mich.—USAF's Air Materiel Command has reiterated its pledge to industry subcontractors that it will not permit unwarranted invasion of their specialties by prime manufacturers.

According to Maj. Gen. David H. Baker, AMC's Director of Procurement and Production, subcontractors today account for about 30% of USAF's overall production program, and he is determined to "maximize the use of existing engineering and manufacturing skills and production facilities in all elements of our national economy."

Speaking at an industry meeting called by the Air Force Assn., Gen. Baker emphasized again that there is no economy in having industry or the government "build additional facilities where capacity already exists.

"Duplication of facilities and skills," he declared "would undoubtedly strain our already tight economy."

Maintenance of the subcontract structure, he pointed out, is important for its potential in case of war, when rapid expansion of output would be necessary. USAF's new production acceleration program, he said, aims to provide the greatest possible support to air power in being, "regardless of the production levels which may be involved.

The subcontract structure . . . is a critical segment in our industrial readiness policy."

Gen. Baker also said the Air Force has maintained control over the subcontracting of prime manufacturers in order to:

- **Increase the** amount of price competition.
- **Get maximum** benefit from the small business potential.
- **Make sure** that the subcontractors are chosen with proper regard for their skill and ability to produce.
- **Insure maximum** use of existing tools and facilities, both industry and government-owned.
- **Prevent overloading** of a limited number of subcontractors.

Army to Train Redstone Battalion at Huntsville

U. S. Army artillery will start hitting targets at a new long-range next month with the assembling at Redstone Arsenal, Huntsville, Ala., of the 217th Field Artillery Missile Battalion (Redstone).

The new unit, commanded by Lt. Col. Glenn P. Elliott, was described by Army Secretary Wilber M. Brucker as another step in the logical development of the Army's artillery missile weapons system.

During its early stages, the artillery battalion will train at Redstone with the aid of scientists who developed the weapon.

The Army says the Redstone's advanced design will require fewer highly trained specialists than the earlier and shorter-range Corporal.

Military Aviation Funds

The three military services had an unexpended balance of over $21 billion on hand, as of Jan. 1, for aircraft, engines, parts and guided missiles procurement. New contracts during the first half of Fiscal 1956—July through December—reduced the unobligated balance to $12.2 billion on Jan. 1.

	OBLIGATIONS (000 Omitted)		EXPENDITURES (000 Omitted)	
	July 1, 1955 Through Dec. 31, 1956	Unobligated Balance Jan. 1, 1956	July 1, 1955 Through Dec. 31, 1955	Unexpended Balance, June 1, 1956
Aircraft, Engines, Parts				
Air Force	$759,406	$8,095,138	$2,592,209	$12,691,719
Navy	667,944	2,736,334	790,460	5,364,565
Army	−46,764	164,444	38,669	319,168
TOTAL	1,380,586	10,995,916	3,421,338	18,375,452
Guided Missiles				
Air Force	309,353	771,909	240,883	1,363,043
Navy	132,540	199,352	81,156	494,710
Army	161,689	238,984	122,836	843,293
TOTAL	603,582	1,210,245	444,875	2,701,046
Electronics & Communications Equipment				
Air Force	56,168	806,278	259,961	1,368,623
Navy	74,370	136,218	40,432	326,075
Army	20,458	145,248	67,954	465,993
TOTAL	$150,996	$1,087,744	$368,347	$2,160,691

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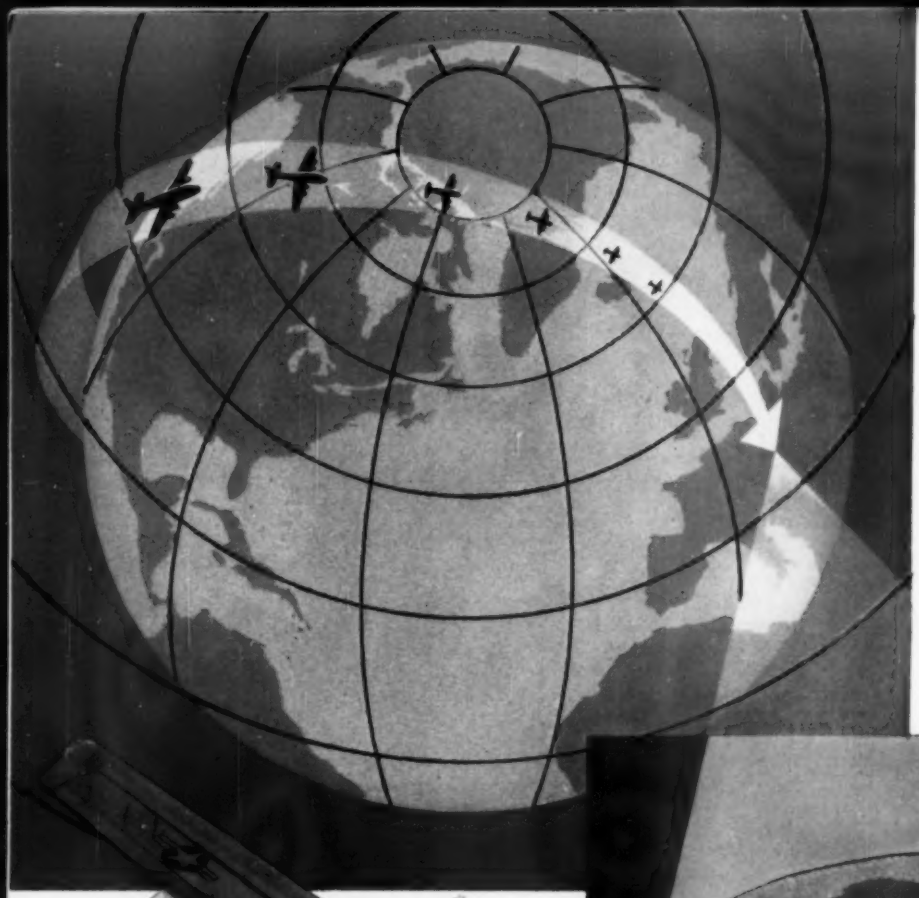

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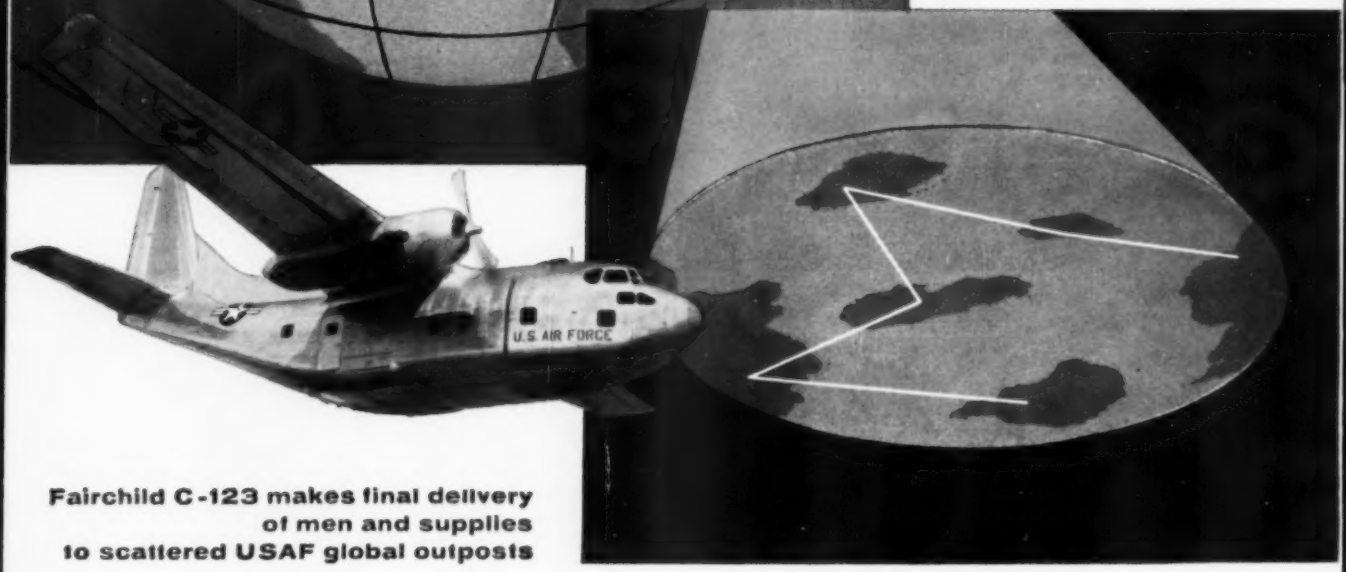

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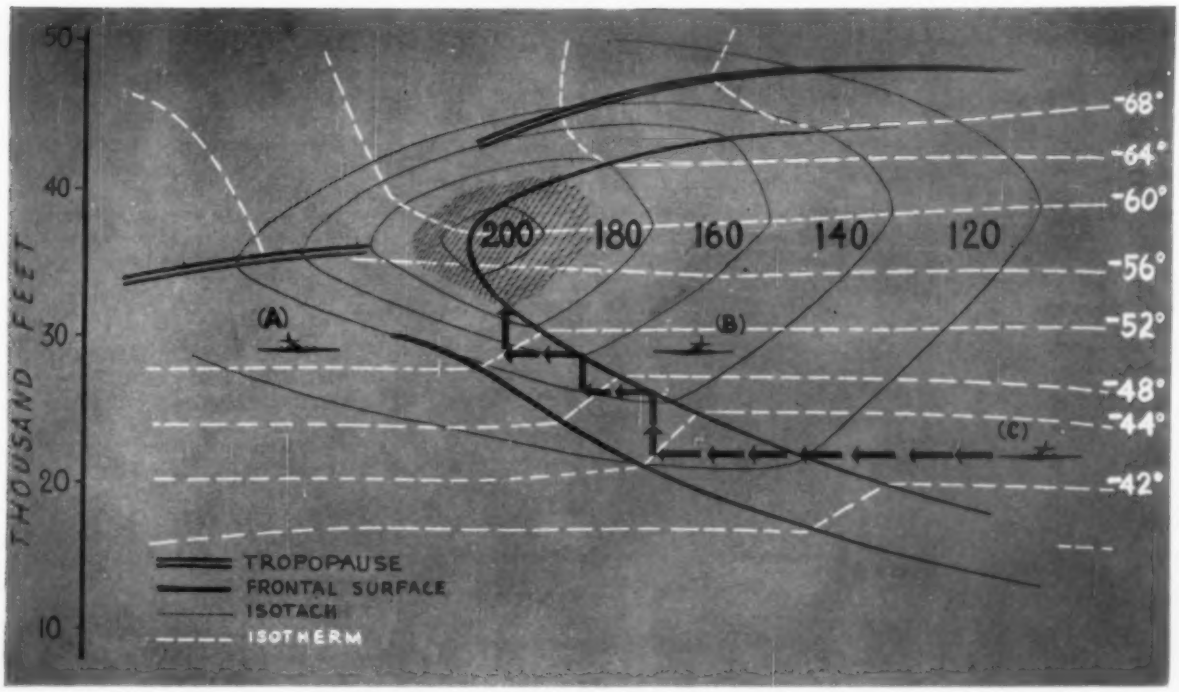

AIRPLANE (A) seeking maximum wind below jet stream flies just to the right (B) of the front identified by steep temperature gradient. Airplane (C) climbs frontal surface in steps to reach core. Isotherms show temperature. Isotachs show wind velocity.

Science Improves Jet-Stream Navigation

By Russell Hawkes

Boston—The westerly jet stream is being made more useful by a new science of flight planning now under development in response to the demand created by modern military aircraft and forthcoming jet transports.

Using a B-29 and a B-47 to probe the structure of high speed winds aloft, Project Jet Stream of the USAF's Atmospheric Analysis Laboratory is roughing out procedures to incorporate jet stream factors in routine Air Force flight plans. Flight crews report that present-day ground forecasts can ordinarily locate a jet stream within about 200 miles. This usually is enough to enable westbound aircraft to avoid the worst of the westerly winds. The task of locating the jet stream more exactly devolves upon the eastbound pilot and navigator.

Cloud forms may provide a useful clue when properly interpreted. Vincent J. Shaefer of the Munitalp Foundation of New York has found certain cloud characteristics to be reliable indicators of the presence of a jet stream. He has identified four high and middle altitude cloud types which are fre-

Jet Stream Phenomenon

Jet streams are ribbons of strong wind which in the temperate zones move along a winding course from west to east.

There is no single uninterrupted stream. Many observers have reported similar ribbons of high-speed, high-altitude wind and feel that a propensity to form into jets of strong wind may be one of the fundamental properties of air near the tropopause which divides the stratosphere above from the troposphere beneath.

The speed of the wind increases extremely rapidly from the edge of a jet stream toward its center, reaching core speeds as high as 250 knots. Meteorologists show this gradient on cross-sectional drawings of a jet stream by means of the roughly concentric isotachs (lines of equal wind velocity).

The structure of the stream includes a jet stream front which extends in a long curve downward and to the south from the core. It is about 2,000 feet thick vertically and about 60 miles wide horizontally. Within the frontal surface a steep temperature gradient is found which declines from south to north at a regular rate of two degrees Centrigrade every 30 miles.

Directly above the southern half of a jet stream the tropopause has been found to curve downward toward the core. Its continuity is broken at the latitude of the core and is resumed immediately to the north at a lower altitude. In higher latitudes the troposphere and the jet streams appear at lower altitudes.

The best known and perhaps the most significant jet stream is that which is linked to the polar front, the boundary between cold polar air and warm tropical air. It appears to be the strongest and most nearly continuous and it may have the most effect upon temperate zone weather. It can usually be found about 750 mi. north of the surface position of the polar front. Occasionally, it shifts suddenly to the north or south but the polar front usually follows it to the new location. Because of the association, this jet is called the polar jet stream.

quently associated with strong winds aloft.

Shaefer has established a preliminary rule of thumb using three criteria to determine whether the jet stream is near.

- **At least three** of the four basic cloud types must be present.
- **The high clouds** must be moving at jet stream velocities.
- **The clouds must** exhibit a coherent pattern extending for a considerable distance along the axis of the jet stream.

A broad sheet of feathery or tufted cirrus clouds stretching from horizon to horizon along the path of the jet stream can often be found immediately to the south of the core. The air to north of the core is usually perfectly clear and the sky is dark blue.

The classic cirrus described by Shaefer is characterized by rapid movement parallel to the course of the jet stream and by a finely barred structure with the bars perpendicular. Curved "mare's tail" formations in the cirrus are cited as evidence of a horizontal line of violent wind shear just above the cloud level.

At lower levels, the jet streams are often accompanied by the lenticular (lens-shaped) altocumulus clouds which are usually associated with vertical standing waves in the lee of mountain ranges. Time lapse photos show that the clouds are actually at the crest of waves made up of air moving at about twice the speed of the wave itself.

Cirrocumulus and billow type altocumulus also are frequently present and may stretch in parallel bands along the course of the jet from horizon to horizon.

Low, fair weather cumulus clouds never attain much vertical depth in the presence of a jet stream. Before the tall, cumulus castellatus clouds can develop, the tops are torn off and the ragged bases lean downwind in the jet stream.

Value Limited

The value of the cloud interpretation system is limited because sometimes, no clouds develop near jet streams. Despite this limitation, Shaefer points to the experience of BOAC Captain Bernard C. Frost as evidence of what can be done. On an eastbound flight across the Atlantic, Frost followed a cloud streak for 1,700 miles, getting an average tail wind of 148 knots. The distance was covered in about four hours.

Correct interpretation of the cloud form made it possible to tap the jet stream for approximately 600 miles of free transportation.

USAF's Project Jet Stream aims to find a more precise and consistently usable technique for approaching the high-speed cores of the jet streams. A method pioneered by pilots flying present day equipment at altitudes between 18,000 and 25,000 ft. is the temperature gradient system. Project scientists believe an extension of this technique will be adopted by the Air Force.

As a rule pilots have been obliged to use altitudes determined by airplane limitations and have been able to reach core altitudes only on the most northerly routes where the jet streams run at lower levels.

The temperature gradient system was developed to help pilots find low-hanging kinks in the isotachs (lines of equal wind velocity surrounding the cores.)

Stream Temperature

Pilots encountering jet stream winds in flight reported temperatures to be constant along the axis of the stream but noted a short, steep lateral temperature gradient within the jet stream frontal surface.

It also was observed that the deepest kinks always intersect the warm side of the frontal surface.

On the basis of this information, BOAC's Frost and others began angling across the course of a jet stream at a predetermined altitude to locate the telltale gradient. By remaining im-

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mediately on the warm side of the front they found they could stay within the maximum westerly winds at any given altitude.

Turbojet aircraft are capable of reaching the core altitudes of all the known jet streams. With their advent the problem of wringing the last extra knot out of the jet streams is projected into three dimensions.

The altitude of the maximum isotach as well as its latitude and longitude must now be learned in flight by the pilot and navigator.

Three-Dimensional Approach

Fortunately, the temperature gradient system, too, can be projected into three dimensions. Project Jet Stream crews approach the anticipated latitude and altitude of the jet stream on a course that roughly bisects the angle between the course of the jet and a line perpendicular to it.

When the frontal temperature gradient is encountered while approaching from the warm side (generally the south) the pilot climbs 1,000 feet and continues on course. If the temperature down-gradient recurs he climbs again and repeats the process until he finds the isothermal level.

The failure to meet a down-gradient identifies the core altitude. If the last climb carries him above the altitude of the maximum isotach, a temperature up-gradient warns him of the fact as he passes over the core.

If he approaches the latitude of the stream from the cold side, the pilot will observe a steep up-gradient as he passes through the jet stream front and need only make a 90 degree turn to the left and continue the stair-step approach along the warm side of the front.

Wind Values

Captain Charles Hawkins, project navigator, says the temperature gradient approach can consistently place the airplane in wind values equal to 85% of the maximum isotach.

Once having found the core, the flight crew must constantly monitor the drift angle and keep it at zero to stay within the maximum isotach ring. The time lag involved in calculating drift by present operational techniques makes this impossible, but according to Hawkins it is effective enough to keep the airplane within the 85% of maximum isotach ring.

Radar Tracking Used

A pair of recently developed automatic navigation radars are proving especially useful for staying within the maximum isotach. The APN-66 and APN-82 radars, developed jointly by USAF and General Precision Laboratories, use Doppler effect to provide ground speed input for the navigation systems.

The APN-66 is favored by project crews because its computer, built by Librascope, Inc., indicates drift angle and wind velocity directly. Air speed and heading inputs are fed automatically from pitot static sources and a compass.

The elimination of manual operations makes it possible to recognize jet stream deviations instantly. The APN-66 also may be linked to the auto-pilot.

Project Jet Stream findings will be embodied in a more extensive revision of flight planning techniques scheduled to start in July. The new techniques will include the results of another study conducted by the Cook Research Laboratories, Skokie, Illinois.

Called optimum flight planning, it will adapt pressure pattern navigation to jet stream core altitudes and transsonic speeds. The optimum flight planning work load will be redistributed to accomplish as much as possible on the ground because of the increased number of parameters in the flight plan and the reduced time span available to make revisions in flight. Another reform would be a revision of meteorological terms to conform more closely to operational terms, thus eliminating the need for translation.

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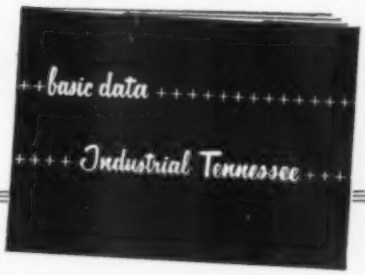

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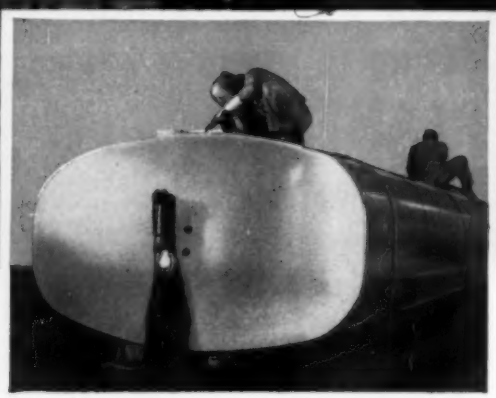

Above, refueling the Viscount at Cleveland Hopkins Airport. At left, a stainless steel filler neck is welded to stainless steel section of the tank at Wilco, Inc., Kenton, Ohio and Shelbyville, Tennessee. There's no weakness here. The welded seams will last as long as the walls themselves.

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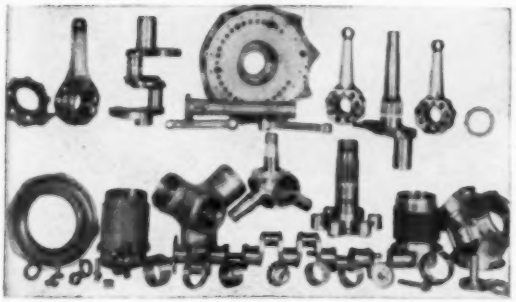

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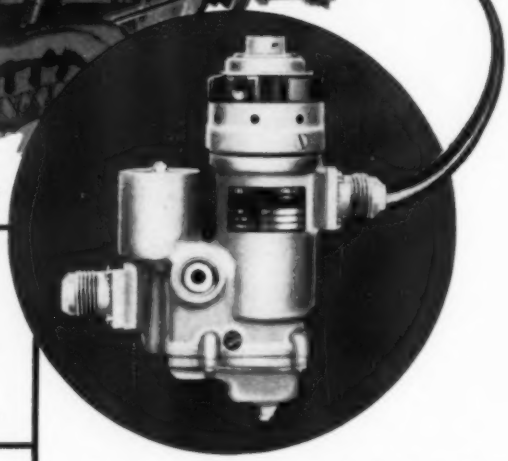

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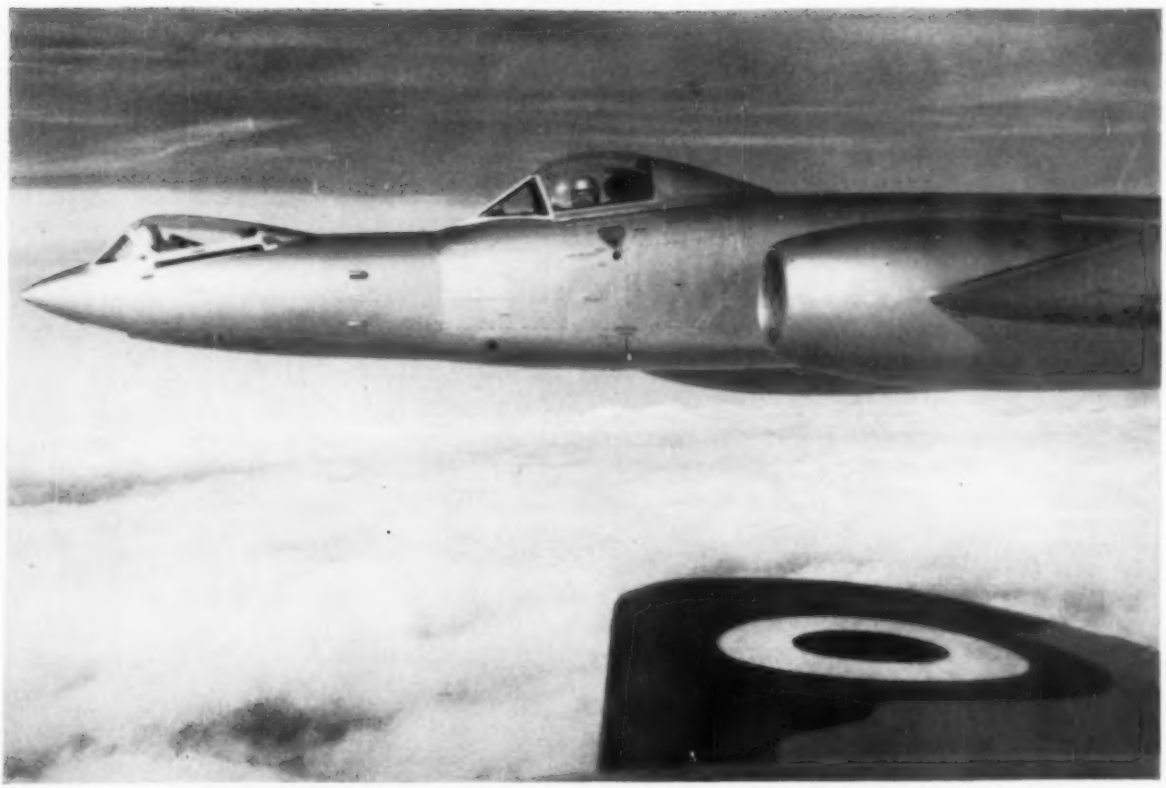


PRONE PILOT IN EXTENDED NOSE of Meteor twin-jet testbed had poor visibility forward and upward, also suffered from fatigue.

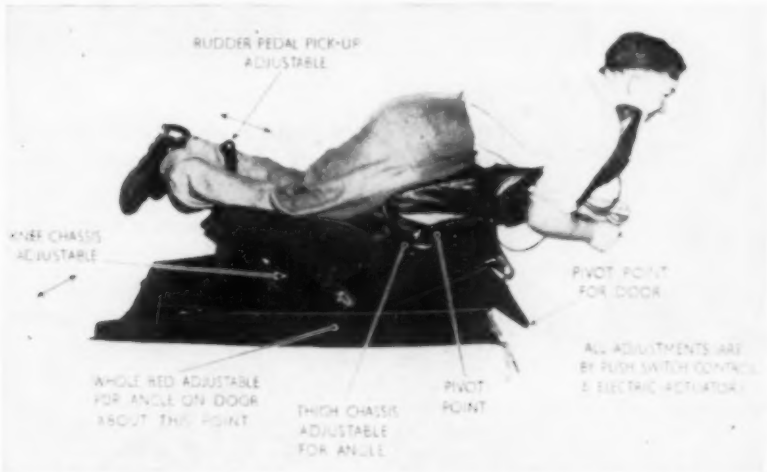
Prone-Cockpit Layout Promotes Fatigue

London—British tests of a prone-pilot cockpit have yielded generally unfavorable results.

Originally intended for use in a rocket-powered interceptor in the design stage in 1951, the prone cockpit later was installed in a Gloster Meteor 8 test vehicle, where it has been under development flight testing for three years.

Flight test findings indicate that:

- **Load factor tolerance** of the prone pilot safely exceeded Meteor structural limits and tests were discontinued at 6.5G.
- **Effectiveness of control** at all attitudes was comparable with the conventional arrangement and was superior for takeoff and landing.
- **Dependent attitude of the arms** caused elbow fatigue after one hour.
- **Pilot was vulnerable** to injury in the event of landing or takeoff accident.
- **Visibility forward and upward was poor.**
- **Prone arrangement was unacceptable** in low-altitude turbulence which caused the pilot to be buffeted about the jaws by the chin rest and pummeled on the chest until breathless.


RUDDER PEDAL PICK-UP ADJUSTABLE
KNEE CHASSIS ADJUSTABLE
PIVOT POINT FOR DOOR
WHOLE BED ADJUSTABLE FOR ANGLE ON DOOR ABOUT THIS POINT
THIGH CHASSIS ADJUSTABLE FOR ANGLE
PIVOT POINT

COMPLEXITY of prone pilot bed is evidenced by numerous adjustments permitting triple articulation to accommodate independent attitudes of trunk, thighs and the lower legs.

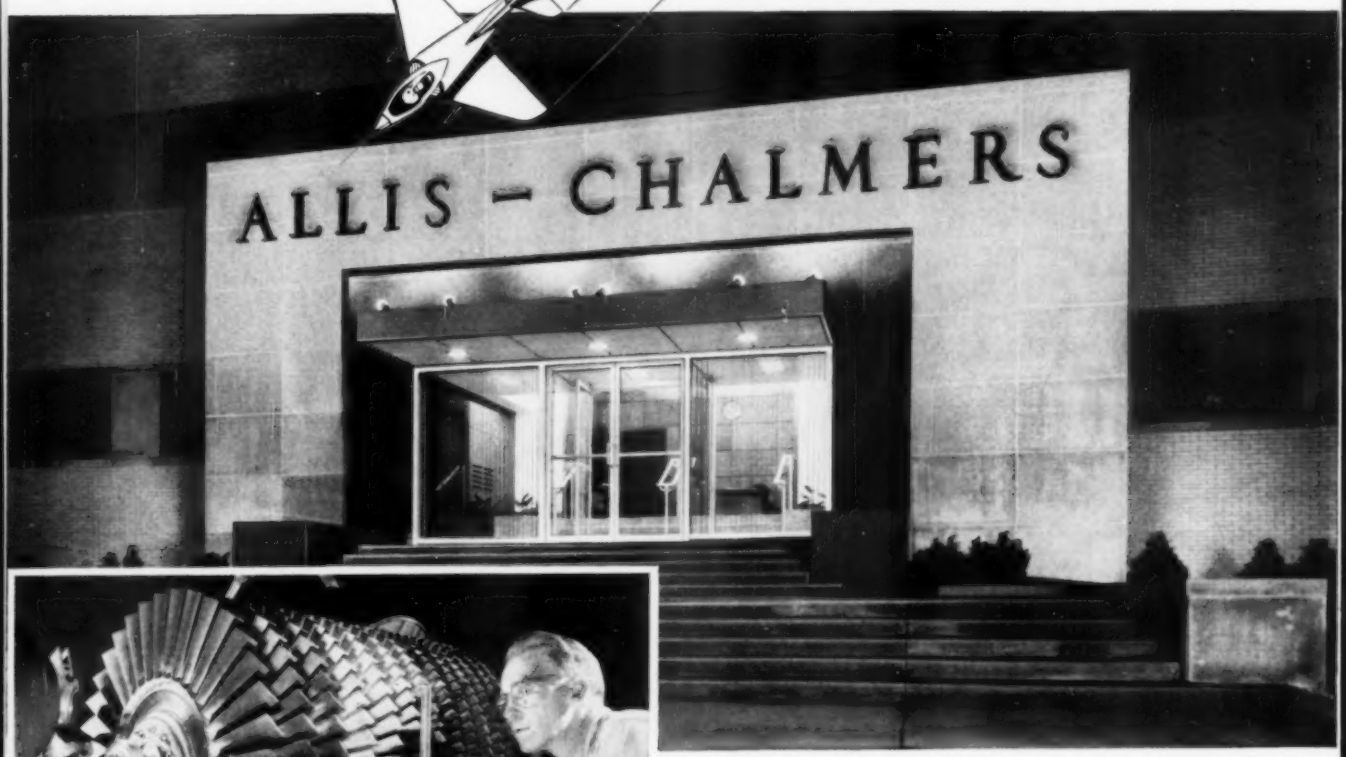
Initial aim of the project was to reduce frontal area and to improve the forward view during climb. But discomfort, complexity and actual reduction in forward visibility made the prone position untenable. Later developments favor a feet-first supine position with optical aids to vision. This scheme produces about the same frontal area, with better visibility.

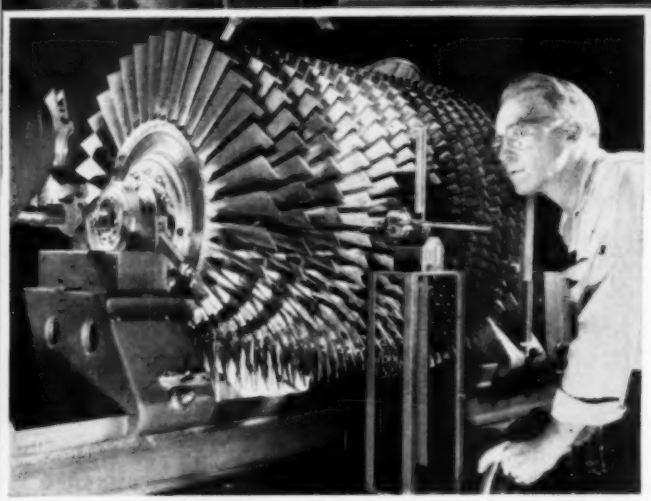
Design Limitations

Development of the prone seat was taken over by the Institute of Aviation Medicine, RAE, Farnborough, solely to determine the physiological characteristics of the prone cockpit.

Initial urgency of the investigation

. . . the place to go for precision machining and fabrication





Axial-flow compressors built by A-C for Curtiss-Wright J65 turbojet engine require highest standards of precision workmanship.

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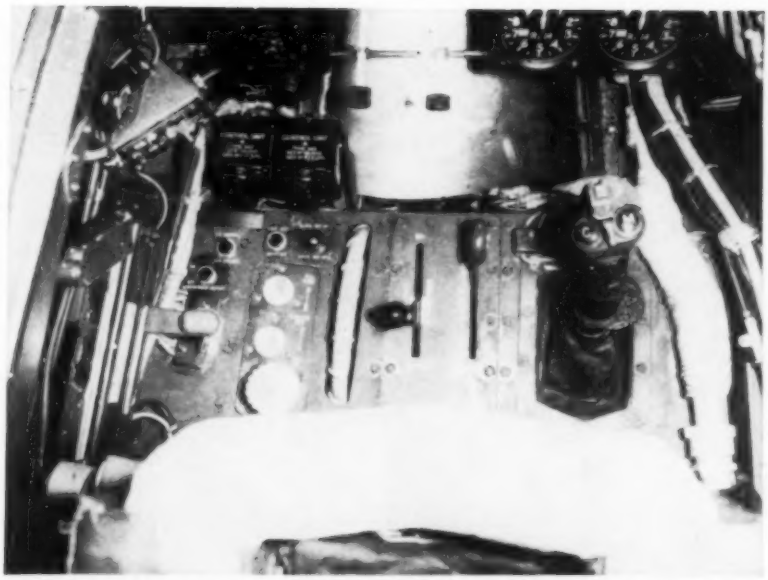


AIRPLANE CONTROLS are shown located ahead of pilot's chin rest at bottom of photo. The control column is on the right; at top center is a transparent flooring.

in 1951 imposed a number of design limitations. The time factor ruled out any development of high-speed ejection equipment. Consequently escape by gravity is restricted to 120 mph, and this requirement has considerably complicated the design.

The need to use available instruments without waiting for special optical aids was another limitation It was not possible to mount gyro instruments obliquely so that these had still to be read directly by the prone pilot.

Only structural modification to the Meteor was the new nose fuselage forward of the original nose wheel bulkhead.

Prone pilot was at all time accompanied by a safety pilot in the normal cockpit, who looked after engine starting and fuel problems.

Preliminary flight tests quickly established the discomfort of the fully prone position. For the remainder of the tests, a semi-prone attitude was used; the pilot's legs were positioned below the trunk, thus reducing the lumbar curvature.

The new position required a bed with triple articulation permitting separate alignment of each section of the chassis accommodating independent attitudes of the trunk, thighs and lower legs. It was also necessary to make the lengths of both the thigh and lower leg chassis variable. All five adjustments are made by electric actuators with pilot controlled sense switching.

Rudder linkage was also complicated by the need to accommodate the rudder pedal position to the position of the adjustable leg extension trolleys.

Escape facilities in the test installation are considered to be over complicated. The bed is hinged to the exit door through the trunk chassis and the trunk actuator. The door is locked hydraulically and opens downward from a forward hinge.

To escape the pilot first pulls a harness release cable which is spring-loaded clear. Pulling a second cable releases a system of spring-loaded levers and bell cranks mounted on semi-closed cam fulcrums. This action causes the chassis members to collapse into alignment, disconnects the rudder linkage and release the door catch. The pilot then energizes the door ram to slide obliquely from the aircraft.

Power boost was found necessary on 11 aircraft controls because of restrictions on arm and shoulder movements. It was proved to be particularly essential for aileron control as the pilot could command only the muscles of the lower arm for the movement.

Schlieren Camera Works in Tunnel

A new camera for schlieren photography which incorporates an electronic programming system and which operates within supersonic wind tunnels has been developed and manufactured by Sherman Fairchild & Associates, Rm. 4628, 30 Rockefeller Plaza, New York.

The 50-lb. unit was conceived under a "crash" program for Task Corp., Pasedena, Calif. for the ultimate use of a West Coast university engaged in secret military research. California Institute of Technology's Jet Propulsion Laboratory has the only university-operated wind tunnel of this type on the West Coast (AW Feb. 13, p. 48).

"This is the first camera designed to perform schlieren photographic research automatically, as far as I know," Karl J. Fairbanks, vice president, told AVIATION WEEK. Previous cameras used in this type of work were adaptations of commercial types located outside wind tunnel chambers, photographing through deep windows, he said.

The Fairchild camera is designed to operate inside the wind tunnel, withstand pressures of from 0.2 to 4 atmospheres and pressure rates of change up to 100 psi./min. This imposed design problems of how to provide pressure equalizing vents between the five large (6-in. dia.) lens elements.

The unit incorporates a reflex viewing window which allows an operator to observe phenomena in the tunnel and take pictures exactly when he wants to.

Here are the functions the camera does automatically with the aid of its electronic control:

Triggers a Hanovia xenon lamp, which produces brilliant illumination for 2/1,000,000th of a second, to freeze supersonic air flow in the tunnel.

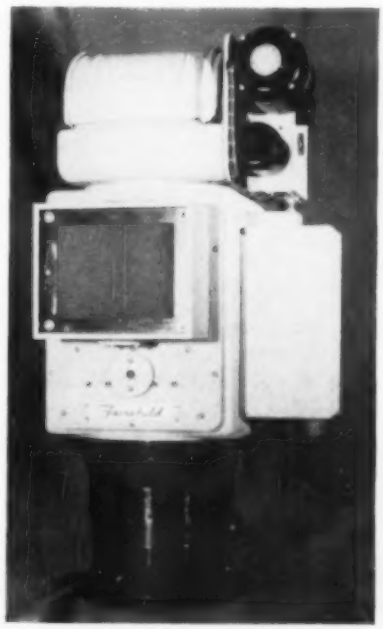
Sequences a series of events with predetermined delays between each step.

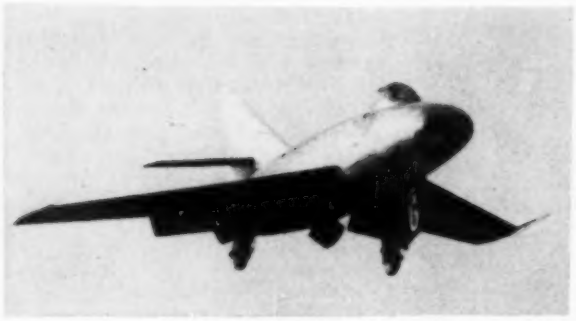
These events are also included in the camera's automatic operation:

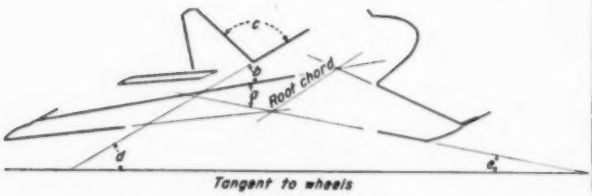
Prior to lamp flash: retract reflex view finder and open shutter.

After flash: close shutter, reset viewer and move film to next exposure.

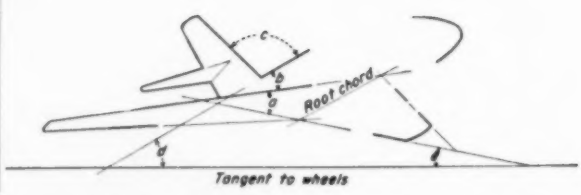
The first unit was recently shipped to Task Corp.







MYSTERE 4B2 was unwitting model for picture of a purported Russian Fighter; geometry of Dassault design is shown below.



MYSTERY RED was supposedly an advanced MiG design; its geometry clearly showed its derivation from the French plane.

Producing Soviet 'Fighters' the Easy Way

By David A. Anderton

Problem: To design a new "Russian fighter" for the propaganda grist mill abroad.

Given: Standard artists' materials.

Solution: Rework a little-used photo of some contemporary fighter.

Two such "solutions" recently appeared. The first was a picture purporting to be a photo of an unidentified Russian fighter; the second was supposedly an illustration of the supersonic Farmer, latest Red day fighter. Both pictures came from sources originally behind the Iron Curtain.

The "unknown fighter" picture was sent to AVIATION WEEK for publication; it was suggested by the sender that this was an advanced MiG, comparable to the North American F-100.

The contemporary fighter that served as the unwitting model for the "Red" was the Dassault Super Mystere 4B2, pictured as it whistled over the fence before touchdown.

First examination of the unidentified fighter produced considerable uncertainty.

The tail assembly looked odd, as if it had been twisted out of line. Strong highlights on the nose indicated that the sun was to the right and a little above the plane, and yet there were no highlights on the vertical tail or metal wheel parts as there should have been.

The grain or fuzziness of the picture was fairly strong, yet markings and insignia were well-defined. But there was no sign of production breaks, which probably would have been evident through the grain if the plane were that close.

For these and other reasons, the picture was not published, but was held in the "suspicious" file.

Linked by Chance

In September 1955, an AVIATION WEEK editor visiting the Dassault plant was picking out pictures to illustrate a story on that company's light fighter. Among the collection was a sequence of the Super Mystere. One picture in the sequence looked very familiar; it showed the Mystere just before landing. The first thought was that the picture had been used previously, but a second thought unearthed the spurious Red from memory.

Back in this country, the Mystere shot was compared with the "Red" fighter.

They looked similar; the point was to prove it.

The first step was to make enlargements of both pictures, blowing them up as far as possible before the grain became too big, to make measurements certain.

The enlargements were made to the same size, using the wing leading edge and the distance between the main wheels as control dimensions.

Then it was possible to trace the Mystere outlines and—by shifting the paper around—to almost duplicate the "Russian" geometry. Attempts to work backwards from the perspective of the "Red" photo to a standard orthographic three-view projection failed. The best bet seemed to be to construct a network of lines determined by the airplanes' geometry and to compare the angles of intersection of these lines.

Linked by Geometry

The results of that experiment are best shown in the illustrations. Five angles of intersection were identical in the two pictures.

- **Angle A,** between the left wing trailing edge and the right wing leading edge.
- **Angle B,** between the left wing leading edge and the fuselage deck line.
- **Angle C,** between the fuselage deck and the fin leading edge.
- **Angle D,** between the tangent to the wheels and the fuselage deck line.
- **Angle E,** between left wing trailing edge and the tangent to the wheels.

It is true that only one of these angles—A—is in a plane determined by the airplanes' geometry; all the other angles are projections of three-dimensional geometry on the two-dimensional picture plane. But chances of having two airplanes—photographed under similar conditions—with the same projected geometry are astronomical.

There are two more telling clues. The Mystere wing root chord, determined by intersections of leading and

F-100 AND 'FARMER:' Photo of F-100 takeoff (top picture) was basis for drawing of Farmer (below).

trailing edges, is at a positive angle of incidence compared to the fuselage thrust line; this is normal. On the doubtful picture, the same root chord is at a negative incidence, which is unlikely.

The other clue is the angle of the horizontal tail. The Mystere, trimmed for landing and beginning the flareout, has its tail at a negative angle of attack, which is normal with the all-flying surface on that plane. Checking the "Russian fighter" tail layout shows that surface to be at a high positive angle, which does not go with landing configurations.

Conclusion: The "Russian fighter" is a clever attempt at designing an aircraft of reasonable appearance, based on a photograph of a Dassault Mystere 4B2 in landing attitude. Therefore the "Russian fighter" is spurious.

The picture of the supposed Farmer (above) originated in Poland, where it was referred to as a Mikoyan design. Again, a careful examination of the rendering showed familiar characteristics; the wing, landing gear and horizontal tail were too much like the North American F-100.

Checking the photo file turned up the proper picture: A shot of the first production F-100 taking off from Los Angeles International Airport. It was easy to see the inspiration for the Polish artist.

There was less work involved in making the F-100 into the "Farmer;" major changes were in the nose and vertical tail. Even the jet blast was kept in the picture to lend "authenticity." Minor changes were made in the position of the right main gear and the nose gear and its door. The flight test boom on the F-100 stayed.

Conclusion: Farmer, as shown in the Polish illustration, is reworked from the North American F-100.

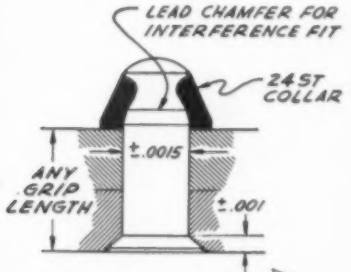
New Bendix Divisions Will Open in June

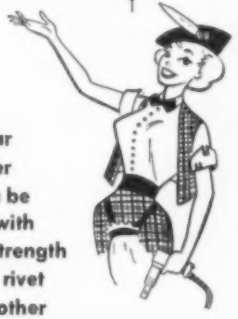
Palmdale, Calif.—Bendix Products and Utica Divisions, dealing with landing gear and fuel metering and with combustion starters and air turbine accessories, respectively, will start operations in new $359,000 facilities here about June 1.

Two buildings, 5,600 sq. ft. for Bendix Products and 2,000 sq. ft. for Utica will be located on nine and half acres in the vicinity of Palmdale Airport, where Northrop Aircraft, Convair, Lockheed and North American Aviation have final assembly plants. In addition, the plants will furnish service to USAF's Edwards Flight Test Center, Nellis AFB and George AFB, as well as the Navy's Mojave Air Station.

A small staff of highly trained mechanics and technicians will be assembled from Bendix plants in Burbank and Los Angeles in the east. This cadre will be expanded slightly by new personnel.

IT'S A BARGAIN— this *hi-shear*





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Communications Bog Handicaps USAF

By Philip J. Klass

New York—A major improvement in Air Force communications facilities and techniques is needed if the Strategic and Tactical Air Commands are to effectively carry out their global commitments.

This warning was sounded by USAF officials during a symposium on Air Force communications and electronics problems and philosphies sponsored by the Institute of Radio Engineers' Professional Group on Military Electronics.

Typical limitations placed on SAC and TAC operations by present equipment and facilities as cited by symposium panel members included:

• 75-80% of all available channels in the USAF's worldwide communications network (GlobeCom) frequently are tied up by the minimum needs of the Strategic Air Command's routine training missions.

This leaves the remaining 20-25% to handle all the rest of the Air Force commands.

• Tactical Air Command, which must be able to pick up and move on a moment's notice to any far corner of the globe, requires 10 C-124 Globemasters to transport the communications-and-traffic-control equipment required for a single wing task force—an indication of the amount and bulk of present equipment.

These and other problems cited during the symposium reflect the fact that communications facilities and techniques have not kept pace with Air Force needs arising from its global commitments, supersonic speeds and nuclear warfare.

Not Entirely Black

The picture is not entirely black, however. The scatter communications technique, which has made it possible to transmit VHF far beyond the horizon (650 to 1,200 miles), was called "one of our greatest technological breakthroughs" by Col. Forest W. Donkin, deputy commander of the Military Air Transport System's Airways and Air Communications Service. Reliability of trans-horizon VHF is far better than the previous HF used for long-distance communications, Donkin said.

Although trans-horizon VHF is presently used only for teletype, Donkin said recent tests indicate that the technique also can provide reasonably good voice communications. Trans-horizon UHF communications is adequate for voice, Donkin told the symposium, but has not yet reached a point of sufficient reliability for teletype use.

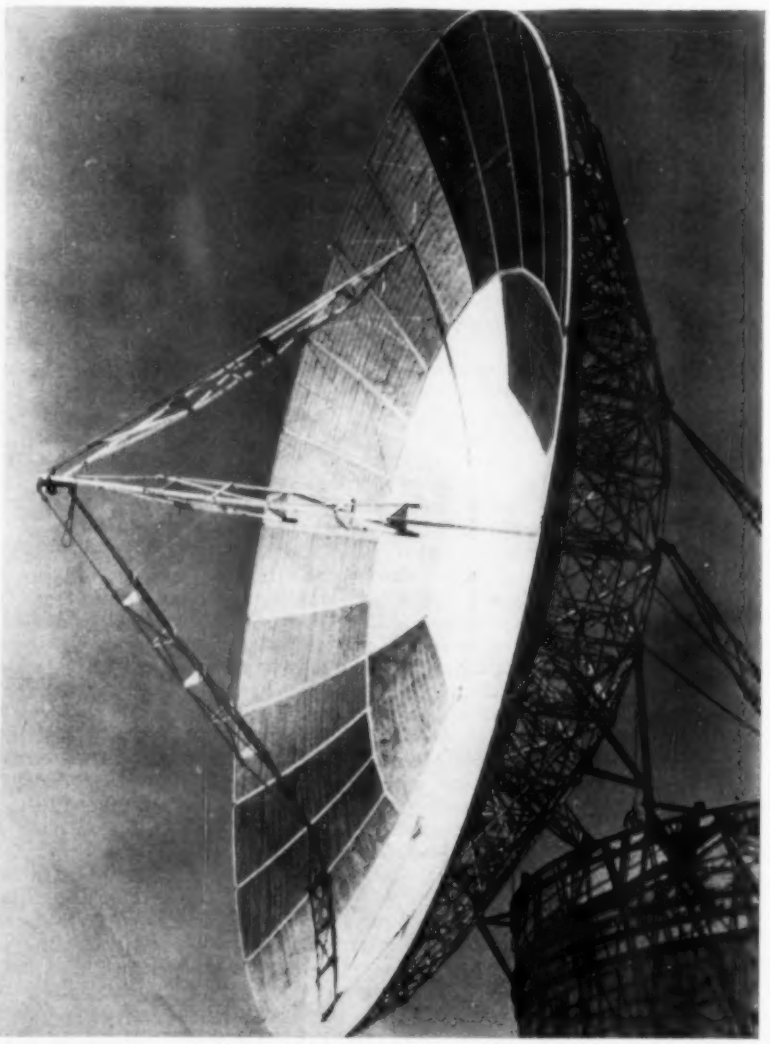
What the USAF Needs

In its high frequency voice and teletype communications, the Air Force is converting to the new single sideband techniques. These new techniques effectively double the number of available channels and simultaneously give better transmission and intelligibility.

In addition to the ever-present need for greater reliability and more efficient use of congested radio spectrum cited by several symposium speakers, the following needs were emphasized:

• **Use of new digital communications** techniques, in which voice modulation is converted into pulse-coded form to reduce the required bandwidth and increase the number of available channels. Development and adoption of such digital communications equipment has been "far too slow," Donkin said.

(AVIATION WEEK has learned that the Air Force intends to sponsor the development of digital communications equipment in the near future.)



BEYOND-THE-HORIZON VHF AND UHF present one major technological breakthrough in communications field. 60-ft. antenna shown above is used for UHF trans-horizon work.

• **Improved, higher-speed** facsimile equipment capable of transmitting up to 10 pages per minute is sorely needed by the Strategic Air Command, Col. John B. Bestic told the IRE. Bestic, chief of communications and electronics for SAC, indicated that another pressing need is for airborne facsimile equipment capable of transmitting battle damage photos back to headquarters immediately after a strike.

• **Increased private-line** direct communications facilities to connect SAC's U. S. and overseas basis are needed to permit command decisions to be made and transmitted at speeds comparable to those at which SAC bombers fly. Arranging for in-air refueling, which SAC bombers make on the average of once every 3½ minutes every hour of the day, require speedy communications and control.

• **Highly mobile** scatter and single sideband communications systems are sorely needed by TAC, according to Col. Robert Frost, deputy Chief of Staff for communications (TAC).

• **Mobile electronic data** processing equipment, capable of automatically keeping tab on up to 1,000 individual aircraft is another TAC requirement.

More Mobility Needed

"Mobility is the key to tactical air power," Frost told the IRE. He also indicated that TAC's avionics equipment leaves much to be desired in terms of mobility.

For example, he said, TAC's "mobile" surveillance radar, the MPS-11, weighs five tons and requires another 62½ tons of supporting material, including nine vehicles and power supplies.

During the recent Sagebrush exercise, TAC had to transport nearly 1,000 tons of communications and traffic-control gear, 5,500 tons of supporting equipment, plus another 3,600 tons of personnel and their supplies, Frost said.

The very nature of TAC's operations in a combat area demand dispersal of its operations, yet this multiplies the need for communications and control equipment.

TAC's drive for greater mobility suggests that its future ground avionics equipment may employ techniques now used in airborne avionics.

Airborne Avionics Problems

Frost indicated, in fact, that TAC is considering the use of 400 cycle a.c. power to replace the present 60 cycles in order to reduce the size and weight of equipment and power supplies. He also called for design of a "family of power supplies constructed in building block fashion" to enable TAC to tailor the supply to its momentary needs and reduce the amount of "impedimenta" the command must transport.

The Air Force has not yet fully recovered from the effects of the postwar switch from VHF to UHF for ground-air communications and the need for flush-type antennas for high-speed jets, John Keto, technical director of the Wright Air Development Center, told the IRE symposium.

The objective of providing good coverage in all important directions from the aircraft, despite its maneuvers, has not yet been achieved, Keto said. Now belly-mounted flush antennas, he reported, give better forward coverage than previous tailcap antennas, but there is room for further improvement. The use of multiple (diversity) antennas mounted in several locations on the fuselage offers some help, but problems remain.

Possibly the most encouraging accomplishment has been made in reducing the tremendous number of crystals which previously had to be purchased and stocked around the world. During World War II, the Air Force had to maintain a "bank" of some 15 million crystals, Keto indicated. The World War II SCR-522 radio set required two crystals for each of its possible 311 different channels. By contrast, today's AN/ARC-34 UHF transceiver, which has 1,750 different channels, uses only 18 crystals.

Another encouraging note: reliability of USAF communications equipment is getting better. Keto reported that the ARC-34 and the ARC-21 HF transceiver now operate for an average of 150 hours between failures, Keto reported.

"Hardware-Ability"

"The Air Force does not have, and won't have sufficient maintenance personnel, either in quality or quantity to 'wet nurse' its equipment," Major General Gordon A. Blake warned the IRE symposium.

Blake is chief communications officer of the Air Force. The USAF is broadening its campaign for greater reliability to include such things as maintainability and producibility—which Blake wraps up in a single expression: "hardware-ability."

Blake said experience has shown that wherever the ultimate user and the designer of equipment work closely together, a better, more useable product results.

Blake added that the recently-formed IRE Professional Group on Military Electronics should aid in accomplishing this objective. The communications expert also urged the IRE to work closely with the Armed Services Communications and Electronics Association.

FILTER CENTER

IRE Highlights

Scatter Interference Minimized—The view that UHF scatter communications creates a great deal of interference over a large area was debunked by R. M. Ringoen of Collins Radio Co. Because of the fewer stations and frequencies involved and the minimum bandwidths employed, Ringoen said that a UHF trans-horizon system produces only about ¼ to ½ the interference of line-of-sight systems providing the same service. He concluded that scatter communications should not be rejected for use because of interference.

Stripline Isolator—A technique for making a ferrite isolator for use with printed-circuit stripline waveguide, capable of providing isolations in excess of 16 db, was described by Oliver W. Fix of Holloman AF Base, N. M. The technique involves the use of balanced stripline, split in a power divider, with a difference of a quarter wavelength in the length of the two legs and a ferrite material inserted between the conductors and the ground plane.

"Electrets"—A new device which is capable of internally storing a charge for long periods of time, called an "Electret," may find use as electrostatic storage devices for computers or in a number of other applications. "Electrets" are formed by the application of heat and direct current potentials of about 35 kv. per cm. across certain dielectric materials for about 12 hours, after which the dielectric is gradually cooled. The "electrets" have a charge of about 3 x 10-9 coulomb per sq. cm. and can be discharged temporarily by the action of X-rays, abrasion, ionized gases, high humidity or washing with a solvent, according to Erik G. Linden of the Signal Corps. Engineering Laboratories.

Semiconductor Capacitance Amplifier—Because a junction diode biased in the reverse direction behaves like a capacitance with small d.c. losses, Frederick Dill and Louis Depian, Carnegie Institute of Technology, reported that a reversed-bias diode can be used as a capacitance amplifier. They reported tests of such an amplifier which showed a stable voltage gain of more than 30. Dill and Depian conclude that the semiconductor capacitance amplifier offers higher and more stable gain as well as greater power handling capacity than a conventional dielectric amplifier.

Measuring Interface Impedance—Cathode interface impedance, a widespread

cause of vacuum tube performance deterioration, can be measured (both the resistive and capacitive components) quickly and without using an oscilloscope by means of a technique developed and described by W. U. Shipley, General Electric Co., Owensboro, Ky.

New Automation Technique—A Melpar-developed technique for automatically soldering axial-lead components to foil-wire boards, without damaging the components by excessive heat, was described in a joint paper by A. A. Lawson, P. E. Ritt, Jr., and H. K. Hazel of Melpar, Falls Church, Va. The technique, developed for use with the firm's Mini-Mech process of mechanized assembly, involves the use of a heated anvil which simultaneously crimps the component leads and solders them to the board. The heated anvil is in contact with the component leads for only 0.4 second.

Bombing System Reliability Gains—A 30% improvement in the reliability of the Sperry K-series bombing systems, used in the B-36, B-47 and B-52, has resulted in less than two years from joint USAF-industry efforts, R. L. Wendt and M. G. H. Smith of Sperry reported. The system, which includes both radar and optical bombing and navigation provisions, is made up of some 79,000 individual parts.

Miniature High-Temperature Isolator—A novel miniaturized X-band isolator using a single slab of nickel ferrite, which gives more than 10 db. isolation with an insertion loss of less than 1 db. over the temperature range of −50C to 150C and has a VSWR less than 1.1 over a 400 mc. band, was described in a paper by R. F. Sullivan and R. C. LeCraw of the Diamond Ordnance Fuze Laboratories, Washington, D. C. The ferrite slab measures only 0.1 in. thick by 1½ in. long and is displaced approximately 0.04 in. from the guide wall.

Wafer Coil Pulse Transformer—Wafer coils, made by slicing rolls of copper or aluminum foil (AW June 14, '54, p. 68) are ideally suited for use in pulse transformers, Alfred Babcock and Albert Zack reported. The two men are with Sylvania Electric, Ipswich, Mass. Wafer coil pulse transformers exhibit very short rise time, negligible wave shape distortion, can be operated at both high and low repetition rates. They also maintain a uniform response over a broad frequency range, the authors stated. Another advantage is that changes in pulse amplitude and impedance can be obtained without major change in transformer shape or size.

Two Approaches to Reliability—Two different approaches to the problem of improving reliability were suggested by W. F. Luebbert, Stanford Research Institute; Fred Moskowitz and J. B. McLean, Rome Air Development Center:

- **Educate the military users** on how to get the most out of their present equipment was one recommendation for manufacturers made by Luebbert.
- **Element-by-element redundancy** in equipment, with automatic provision for sensing failure and switching the standby element into the circuit, was the recommendation of Moskowitz and McLean. The authors indicated that this approach is more desirable than using a complete dual standby system.

TRACALS Program Outlines—The USAF's systems engineering approach to the traffic control and landing problem, being handled under its TRACALS (Traffic Control Approach and Landing System) project, is expected to result in an electronic geographic coordinate navigation system, automatic scheduling of the initial phase of an approach, automatic approach and landing and even automatic airfield surface guidance within the next decade, Ernest N. Storrs and Joseph L. Ryerson told the IRE. Both are members of the Rome Air Development Center.

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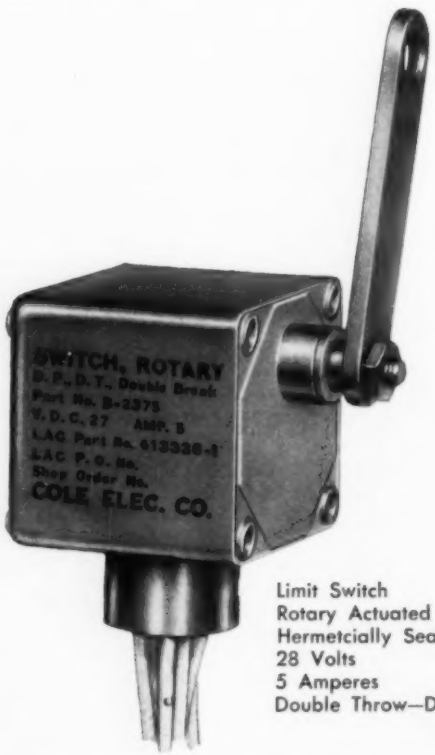

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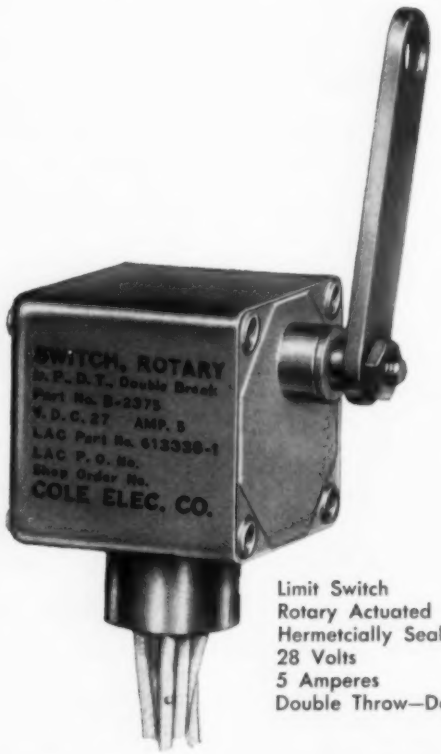

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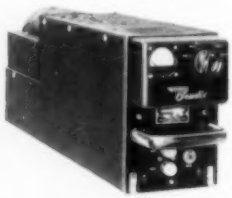
ANA-18A VHF ANTENNA Streamlined design reduces drag to minimum for high speed aircraft. Has pressure sealing gasket and hermetically sealed coaxial fitting for pressurized aircraft. Covers 118.0 to 135.95 mc. range.

MS-192C VHF NAVIGATION ANTENNA Aerodynamically streamlined for minimum drag. This horizontally polarized, broadband, non-directional antenna is designed for reception of all VHF navigation and localizer signals.

MN-97H OMNI-MAG Visual reception of VOR, ILS and relative magnetic heading information in a single instrument. Optional features include standard or expanded range movement (vertical bar), matte white or radium lettering.

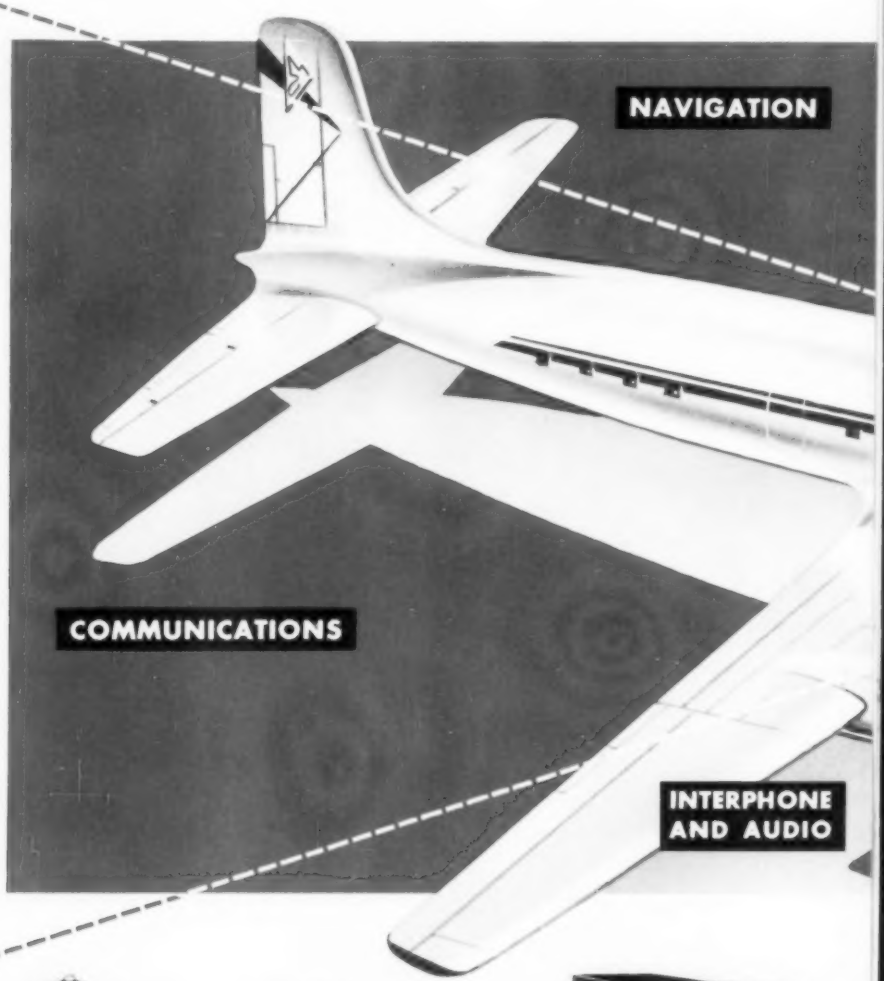
MN-85F VHF NAVIGATION RECEIVER Provides visual and aural reception of all VHF navigation aids including localizer. 280 crystal controlled channels, spaced 100 kilocycles apart from 108.0 to 135.95 mc.



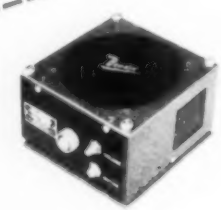
TA-20A VHF COMMUNICATIONS TRANSMITTER 360 crystal controlled channels from 118.0 to 135.95 mc. 50-kilocycle channel spacing. Provides 30 watts of r-f output power. Built-in meter and switch permits checking currents in six major circuits.

RA-18C-1 VHF COMMUNICATIONS RECEIVER Provides 360 crystal controlled channels from 118.0 to 135.95 mc. 50-kilocycle channel spacing. 3-microvolt sensitivity. Carrier operated squelch control.

SLA-18( ) CONTROL PANEL Selects VHF transmitter and receiver channels simultaneously. Concentric knob volume control optional. Uses Bendix DA-NITE system of illumination providing white numerals during the day and red lighted numerals at night.



SCL-3A SELECTIVE CALLING UNIT Eliminates use of headphones and gives simultaneous monitoring of ATC and company channels. Flashing light alerts pilot to call from ground even when monitoring another channel.



MI-51A AMSPEAKER Compact cockpit loudspeaker system. Contains amplifier, power supply and loudspeaker in single unit. Can replace or supplement use of headphones. Provides 4 watts audio output.

CNA-2C TRANSISTORIZED AUDIO CONTROL PANEL For eleven receiver, three interphone and four transmitter selectors. Range filters are incorporated for ADF signals. Designed to customer specifications.

MI-36 ( ) PASSENGER ADDRESS AMPLIFIER For paging, announcing and entertainment use. Available for use with either dynamic or carbon microphones.

MN-100A GLIDE SLOPE RECEIVER 20 crystal controlled channels from 329.3 to 335.0 mc. for reception of tone-modulated 90/150 cps. glide slope information. Control panel may be wired for simultaneous frequency selection of localizer and Glide Slope.

MKA-7A MARKER RECEIVER New ¼ ATR, 75 mc. marker receiver weighs only 8.5 pounds with power supply. Improved circuitry greatly reduces possibility of FM or TV interference. Designed for reception of airways and ILS approach markers.

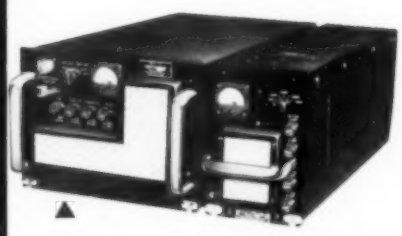
MN-72F RADIO MAGNETIC INDICATOR Dual azimuth indicator provides simultaneous indication of two "heading sensitive" bearings. Used with dual VHF navigation receivers or dual ADF receivers . . . or one of each.

LPA-70A FLUSH LOOP ANTENNA New magnetic type flush mounting antenna designed for use with either old or new ADF systems. Zero drag. Covers frequency range from 90 to 1750 kilocycles.

DFA-70A ADF RECEIVER New ½ ATR automatic direction finder. Features precision, electrical servo tuning system . . . no tach shafts. Covers 90 to 1750 kilocycle range in six bands.

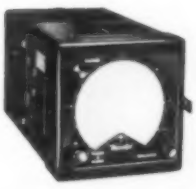
CNA-70A CONTROL PANEL Complete remote control of *DFA-70 Automatic Direction Finding System*. Easy-to-operate controls with finger-tip frequency selection. DA-NITE illumination has white and red dial numerals. Meets RTCA specifications.

ANT-1 ( ) ANTENNA 22" and 30" X-band or C-band nose mounted weather radar antenna for airline and executive aircraft. X-band includes cosecant squared pattern.



SYN-1B SYNCHRONIZER-AMPLIFIER-POWER SUPPLY New ½ ATR synchronizer for airborne weather radar system weighs only 21 lbs. Silicon diodes and improved circuitry has reduced size and weight 50% +. Considerable reduction in power requirements.

PPI-1 ( ) INDICATOR Provides 0-20, 0-50, and 0-150 mile range displays. Features off-center display (magnetic de-centering) for better interpretation of storm areas on flight path.



RDR-1 ( ) TRANSMITTER-RECEIVER Bendix *RDR-1 AIRBORNE RADAR SYSTEMS* are available with either X-band or C-band transmitter-receivers. Terrain mapping facilities are provided with either system and *RACON* beacon operation is available on all X-band units.

CON-1D CONTROL UNIT For remote control of RDR-1 AIRBORNE RADAR SYSTEM (except for controls located on indicator face). Incorporates Bendix DA-NITE system of illumination.

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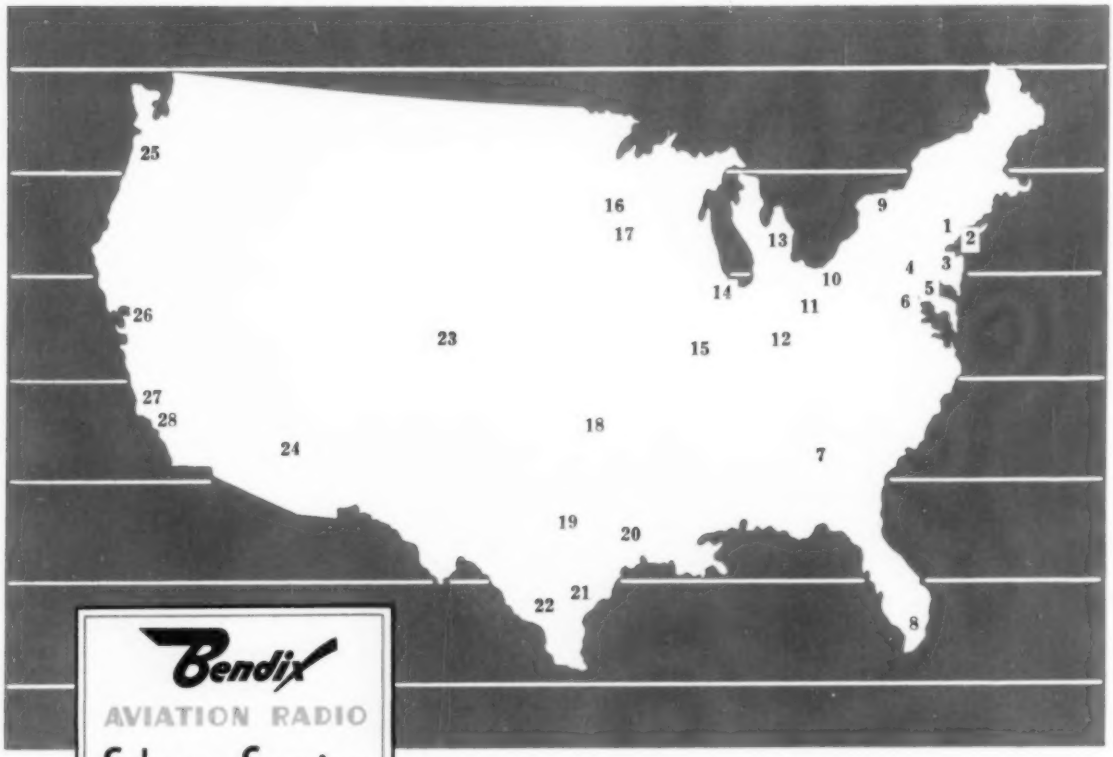

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5. **ATLANTIC AVIATION SERVICE**
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Akron, Ohio

11. **OHIO AVIATION CO.**
P. O. Box 305
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Bowman Field
Louisville, Kentucky

13. **ANDERSON AIRCRAFT RADIO**
Detroit City Airport
Detroit 5, Michigan

14. **SKYMOTIVE, INC.**
O'Hare Field, Chicago Int'l Airport
Park Ridge, Illinois

15. **REMMERT WERNER, INC. (NAVCO)**
Lambert Field
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Wold Chamberlain Field
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17. **GOPHER AVIATION**
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24. **AERO ELECTRONICS, INC.**
Maricopa County
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25. **KARPURK ELECTRONIC SERVICE**
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26. **BAYAIRE AVIONICS, INC.**
Oakland Airport
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27. **QUALITRON, INC.**
Lockheed Air Terminal
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28. **AIRESEARCH AVIATION SERVICE**
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* **ANCHORAGE AIRBORNE RADIO AND ELECTRONICS, INC.**
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Canadian Distributor: Aviation Electric, Ltd., 200 Laurentian Blvd., Montreal, Quebec

Expansions, Changes In Avionics Industry

General Precision Laboratory, Inc., Pleasantville, N. Y., has formed a new Avionic Sales Division, to support engineering activities of its Avionic Engineering Division. The new division will be headed by William J. Tull.

Other recent expansions and changes in the avionics industry include:

• **Cubic Corp.,** San Diego manufacturer of instrumentation, is building a new facility in the San Diego-Kearny Mesa Industrial Area. First unit of the 220,000-sq. ft. development will house expanded research, development and production activities.

• **Pacific Automation Products, Inc.,** Glendale, Calif., is name of new firm which will specialize in cable for missiles and industrial use. Firm is headed by Frank G. Jameson.

• **Electronic Engineering Co. of California,** Los Angeles, has signed agreement with newly formed Electronic Systems Development Corp. for technical consulting services. The new firm is headed by Dr. Otto G. Schwede and Theodor F. Sturm, former German scientists who recently resigned from the Naval Air Missile Test Center staff at Pt. Muga, Calif.

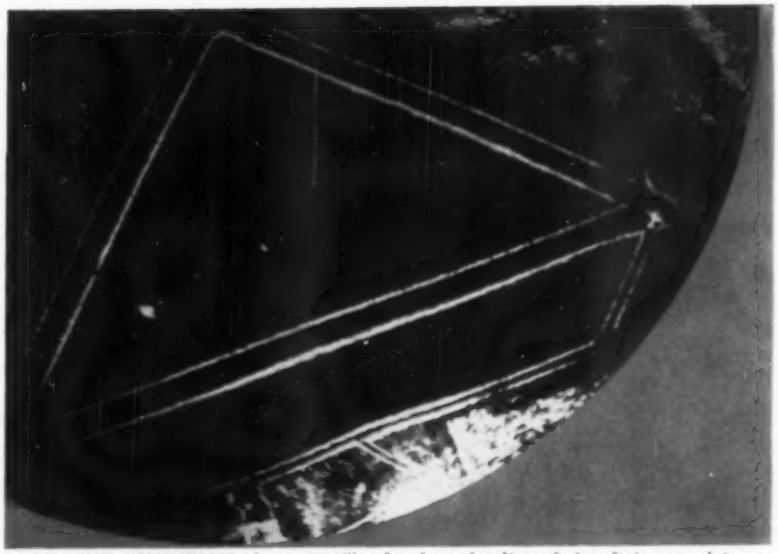
• **General Electric's Light Military Electronic Equipment Dept.** has opened a new district office in Seattle, at 220 Dawson St., headed by Kenneth T. Casey.

• **Arga Division of Beckman Instruments, Inc.,** South Pasadena, Calif., has purchased the entire inventory of Belock Instrument Corp., New York. The Belock line of magnetic clutches, servo motor gear heads, and other servo system elements will be added to Arga's line of servo components and systems.

• **Donner Scientific Co.,** Berkeley, Calif., maker of instrumentation, will build a new air conditioned 22,000-sq. ft. plant in Concord, Calif. New facility, slated for completion in June, will house engineering, manufacturing and administrative operations now in Berkeley.

• **Axel Brothers, Inc.,** Long Island City, N. Y., maker of filters and capacitors, is moving to new enlarged facilities at 134-20 Jamaica Ave., Jamaica, N. Y. The new facility was a former plant of the Fairchild Camera & Instrument Corp.

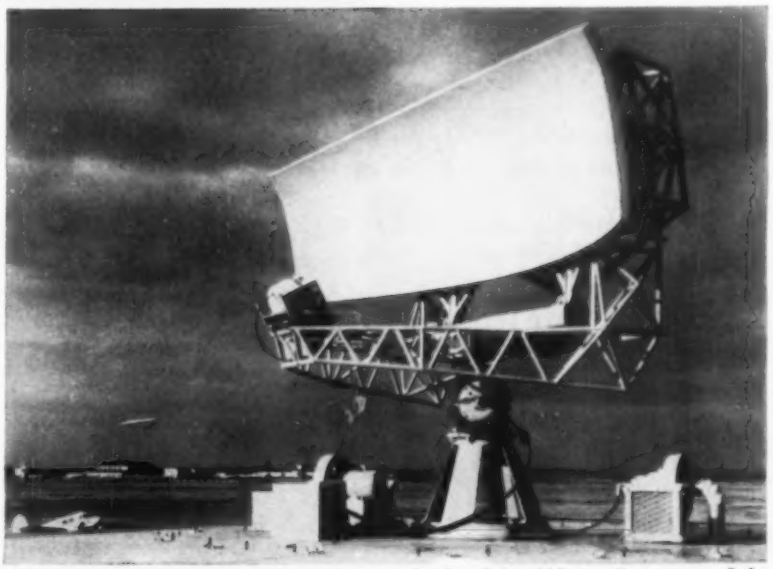
• **Olympic Radio & Television, Inc.,** Long Island City, N. Y., maker of military avionics equipment and consumer goods, has retained D. K. MacLennan Co. as its West Coast representative. MacLennan's address is 921 Westwood Blvd., Los Angeles, Calif.



EXCELLENT DEFINITION of new "taxi" radar shows heading of aircraft (runway intersection, right) as well as number of engines, better enabling controller to identify aircraft.

'Taxi Radar' Boon to Controllers

New Airport Surface Detection Equipment (ASDE), or "taxi radar" as it is commonly called, will enable airport controllers to instantly tell when runways and taxi strips are vacant. High definition of new ASDE clearly shows aircraft wings, fuselage, and number of engines for better aircraft identification. Developed under Rome Air Development Center sponsorship by Airborne Instruments Labs., the new set has been delivered to RADC for tests after which it will be installed at N. Y. International Airport for operational evaluation. Radar operates at 24,000 mc. and has beamwidth of ¼ degree.

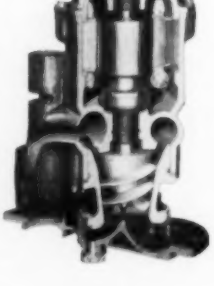


TAXI RADAR ANTENNA, and console were developed by Airborne Instruments Labs.

CHANCE VOUGHT F8U-1

crusader performance figures?...s-ssh!

To be specific—they're terrific! But unmentionable. However, there's nothing unmentionable about the Crusader's Fuel Booster Pumps. They're HY-V/L Pumps, all 6 of 'em (yes—SIX). To be even more specific, HY-V/L pumps have *Design Predictability;* the HY-V/L can be tailored to *your* specific needs. So be specific! Sit down and mention your fuel pump problems in a letter to Hydro-Aire right now.



HY$^{V}/_{L}$* fuel booster pumps

*VAPOR/LIQUID RATIO

a product of

HYDRO-AIRE *Inc.* *who also make*
FUEL VALVES • TURBO MACHINERY
HOT AIR VALVES • *hytrol*

BURBANK, CALIFORNIA • *Aviation Subsidiary of* CRANE CO.

NEW AVIONIC PRODUCTS

Components & Devices

• **Size 8 servo motor,** Type 8-M, an motor-generator, Type 8-M-G, measu only ¾ in. dia. x 2¼ and 1¾ in. respe tively. Motor operates from 26 v has free speed of 6,700 rpm, stall torqu of 20 in. oz., rotor inertia of 0.5 g cm.². Either or both phases can b wound for any desired voltage up t 52 volts. The Size 8 motor-generat

unit has similar characteristics, exce that rotor inertia is 0.6 gr. cm.². Tac generator output is 0.3 v./1,000 rpn requires power input of 1.8 watts, an has a 5 degree phase shift with 0.0 volts at null. Manufacturer also mak small plug-in transistor servo amplific for driving the motors. Transicoil Corp Worchester (Montgomery County Penna.

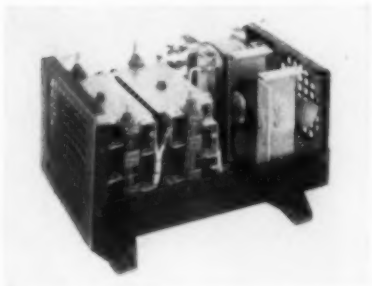
• **Servo amplifiers,** 400 cps., suitab for airborne use, are now available i a line of units rated 2, 4, and 10 watt Companion power supplies and modu

lators are also available. Servomecl anisms, Inc., Eastern Components Div 625 Main St., Westbury, L. I., N. Y

• **Sub-miniature precision wire-woun resistor,** Type 128A, Series PH, is e capsulated and reportedly meets MI R-93A. Operating temperature rang is —65C to 125C, temperature c efficient is 0.0022% per deg. C, resis ance accuracy is 0.05%, and units a rated for 0.25 watts, derating to 0. watt at 125C. Maximum resistance

50,000 ohms. Unit measures 0.16 in. dia. x 0.5 in. Hycor Co., Inc., 12970 Bradley Ave., Sylmar, Calif.

• **Airborne d.c. power supply,** Type 28V100, operates from 200 v., 3-phase, 400 cps., delivers 100 amps of 28 v. d.c. Output varies between 25 v., when operating from 195 v. line and delivering 100 amps, to 30.5 v. at no load from a



210 v. line. Unit is rated for continuous operation at 100C, sea level, to 20C at 60,000 feet. Device weighs under 17 lb. Chatham Electronics, Aircraft Equipment Dept., Livingston, N. J.

• **Sub-miniature gas-filled snap switches,** Series 6100, are rated 5 amps resistive, 3 amps inductive, 2 amps motor load, either 28 v.d.c. or 110 v.a.c. Manufacturer reports new switches meet MIL-S-6743 and vibration spec MIL-E-5272, Procedure I. Contract arrangement is SPDT. Life is quoted at 100,000 cycles. Hayden Switch, Inc., 356 So. Leonard St., Waterbury 20, Conn.

• **Hydrogen thyratron,** Type PL-165, has peak plate voltage of 12 kv., peak plate current of 325 amps. Tube measures 2.56 in. dia. x 6.25 in., including base. Penta Laboratories, Inc., Santa Barbara, Calif.

• **Magnetically tuned variable inducator,** for low-frequency applications, is available with inductance ranges of 1,000 henries and higher and a tuning range of ±10%. Adjustment of inductance is accomplished by screwdriver, which changes position of two permanent magnets. Burnell & Co., Inc., 45 Warburton Ave., Yonkers, N. Y.

Instrumentation

• **Telemetering accelerometer** Model A-7T, employing a variable inductance type transducer for FM/FM telemetering, is available with measuring ranges of ±1 G to ±100 G. Units are damped to 0.7 critical over temperature range of −65F to 160F. North American Instruments, Inc., 2420 N. Lake Ave., Altadena, Calif.

• **Integrating gyro,** Model 1-IG, rate gyro, Model 10-RG, and pendulous accelerometer, Model 10-A, fully floated

AIRCRAFT TRANSDUCERS

PRESSURE OPERATED POTENTIOMETERS

Outputs: Linear and nonlinear functions of applied pressure.
Resistances: 100 to 50,000 ohms.
Ranges: 0-5 to 0-5000 psi.
Types: Absolute and differential.
Vibration Ambient: 0 to 55 cps, 0 to 500 cps, and severe vibration 25g to 2000 cps.
Construction: Hermetically sealed.

Write for Pressure Operated Potentiometer Bulletin

ULTRA-SENSITIVE PRESSURE SYSTEM

Output: 3 volts at full scale.
Range: ±¾ psi, differential.
Resolution: 1 x 10^{-6} psid.
Zero stability: Better than 1 x 10^{-3} psid.

Write for Bulletin EPMS

RESISTANCE BRIDGE PRESSURE PICKUPS

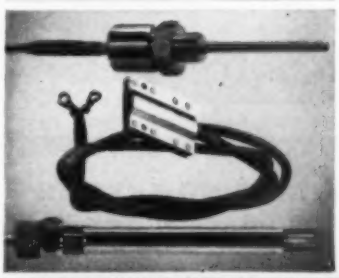
Sensitivity: 5 mv/v at full scale.
Ranges: 0-10 to 0-1500 psi.
Types: Absolute and differential.
Construction: Hermetically sealed.

Write for Bulletin No. 7

RATE OF CLIMB

Outputs: 5 volt signal and/or dial indicator.
Range: ±25,000 ft./min.
Time constant: 0.2 sec. at sea level to 2 sec. at 50,000 ft.

Write for Vertical Speed Transducer Bulletin



RESISTANCE THERMOMETERS

Resistance: 5 to 500 ohms at 32°F.
Materials: Platinum or nickel.
Range: −350 to +2000°F.
Types: Liquid, surface, gas.
Characteristics: Corrosion proof, severe vibration ambient, fast speed of response.

Write for Resistance Thermometers Bulletin

"For Transducers See Trans-Sonics"

Trans-Sonics, Inc.

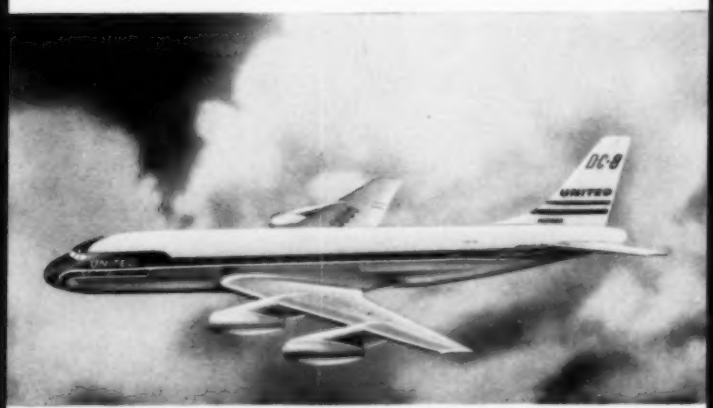
77 FOREST STREET • BEDFORD, MASSACHUSETTS

United specifies Skydrol for entire new jet fleet

In one of the largest commercial jet orders ever placed with one manufacturer, United Air Lines recently purchased thirty Douglas DC-8s for delivery starting in 1959. To help assure maximum operating safety and efficiency for these jets, United specified a fire-resistant Skydrol fluid *for the hydraulic system* (Skydrol 500).

The same advantages that make Skydrol the preferred fire-resistant synthetic hydraulic fluid in piston engine aircraft, also make it superior for use in jets. Skydrol is the only *fire-resistant fluid* approved by the C. A. A. — outlasts, *outperforms* petroleum fluids . . . providing higher lubricity for longer hydraulic component life.

Whatever your needs in hydraulic fluids, there's a Skydrol to do the job best. For more facts, write: Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Box SKD-5, St. Louis, Missouri.



THE DOUGLAS DC-8, powered by four P&W J-57 engines, will carry 112-140 passengers and 7000 lbs. of freight over 3000 miles non-stop at speeds up to 575 m.p.h. Seat-mile costs of operating these jets may even be less than latest piston types.

34 MAJOR AIRLINES NOW USING SKYDROL

LAI	ARAMCO	AIRWORK, LTD.
ANA	U.S.A.F.	NORTHEAST
LASCA	B.O.A.C.	NORTHWEST
SLICK	NATIONAL	AIGLE AZUR
JAL	PANAGRA	CATHAY PACIFIC
PAL	WESTERN	CONTINENTAL
CMA	ALITALIA	FLYING TIGER
KLM	SWISSAIR	PAN AMERICAN
LAN	UNITED	CANADIAN PACIFIC
TAI	AMERICAN	NORTH AMERICAN AIRCOACH
UAT	BRANIFF	TRANS-CARIBBEAN
	DELTA	

MONSANTO

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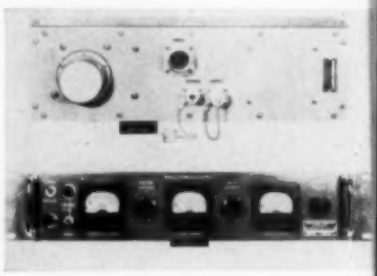
Skydrol: Reg. U. S. Pat. Off.

and hermetically sealed, are being unveiled this month by Reeves Instrument Corp. at the national IRE convention in New York.

• **RF pre-amplifier,** Model APA-2, for improving the signal-to-noise ratio of a telemetering receiver operating in the 215-235 mc. band. Addition of the pre-amp to a receiver with a typical 10 db. noise figure produces a signal-to-



noise improvement comparable to a five-fold increase in transmitter power, according to manufacturer. Device weighs 12¼ lb., operates from 115 v., 60 cps, power. Applied Science Corp. of Princeton, P. O. Box 44, Princeton, N. J.

• **Ultra-sensitive accelerometer,** Model R-1430, for measuring linear accelerations as small as 0.002 G, has a maximum range of ±0.1 G. Total calibration error is quoted at 2%. Unit can

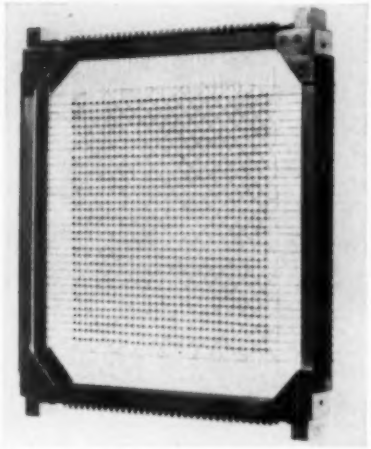
be operated at temperatures up to 325F and is available with potentiometer pick-off. Cedar Engineering, Inc., 5806 W. 36th St., Minneapolis 16, Minn.

Computers & Data Processing

• **Computer drift compensation switch,** for use with analog computers, connects a single a.c. compensating amplifier in sequence to a number of d.c. amplifiers for zero drift or offset compensation. Unit has two poles and is available with 60 or 80 make-before-break contacts per pole at sampling speeds ranging from ¾ to 4 rps. Phas-

ing between poles is adjustable. Applied Science Corp. of Princeton, P.O. Box 44, Princeton, N. J.

• **Magnetic memory core matrices,** in standard frame sizes of 10x10, 16x16, 32x32, or 64x64 cores, completely wired, are available with either Ferra-



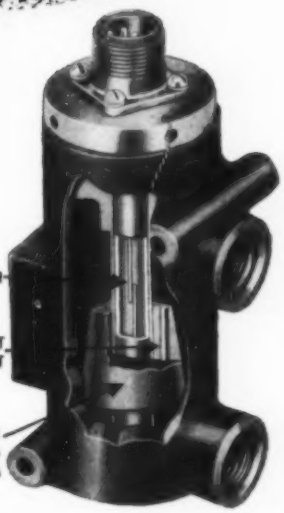
mic S-1 or S-3 memory cores. The devices have one "X," one "Y," one "Z" and one sense winding through each core. General Ceramics Corp., Keasbey, N. J.

• **Codescriber** for coding magnetic tapes for use in digital computers contains arithmetic circuits for address modification, visual indicators for decimal, digit, readout, and register display. Auto-

matic function buttons are provided for automatically inserting all repetitive data as well as sub-routine call-up. Longistics Research, Inc., Redondo Beach, Calif.

• **Low-frequency noise generator,** for use with d.c. analog computers, can simulate air turbulence, radar noise, vibration and other noise interferences. Generator output is a rectangular waveform of constant amplitude and random width which is easily filtered to provide a wide variety of power spectrums and amplitude distributions. Unit does not include power supply or reference

Know when flow is low...
WITH
REVERE FLOW SWITCHES



Know whether fuel flow is safely above required minimum with this Revere flow switch. Only moving part is the float...non-absorbent for long-time accuracy. Permanent magnets in float actuate hermetically sealed Glaswitch* at preset minimum rate. Compact...low pressure drop. For a range of flow rates and pressures.

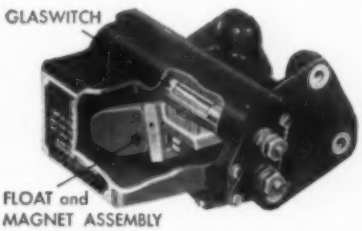
SPECIFICATIONS – F-8290 Flow Switch (typical)
Flow: 1.5 GPM
Weight: 0.70 lb.
Operating Pressure: 70 PSIG
Temperature Range: –65°F to 200°F

Know when a fuel line runs dry ...this Revere flow switch flashes a pilot light. Uses a venturi to create differential head during fuel flow to fill float cavity; this causes float and magnet assembly to actuate hermetically sealed Glaswitch*. Air replacing fuel in line drains switch cavity reversing switch action. Small size . . . low pressure drop.

* Trademark

Ask for Engineering Bulletins 1055 and 1059 describing these Revere Flow Switches. Other types available.

SPECIFICATIONS – F-21110 Flow Switch (typical)
Flow: 3000 PPH minimum
Weight: 1.25 lb.
Operating Pressure: 35 PSIG
Temperature Range: –65°F to 165°F



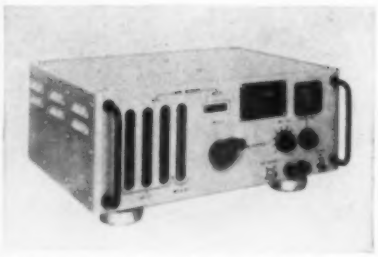
Designed for aviation fuels. Conform to MIL-F-5572, MIL-F-5616 and MIL-F-5624A as well as applicable requirements of MIL-E-5272 and MIL-F-8615.

Revere CORPORATION OF AMERICA 18
WALLINGFORD, CONNECTICUT A Subsidiary of Neptune Meter Company

source. Generator is designed to plug into a power supply chassis or into an Electronics Associates servo mounting rack. J. B. Rea Co., 1723 Cloverfield Blvd., Santa Monica, Calif.

Laboratory Equipment

• **Crystal frequency synthesizer,** Series 182, can produce 2,000 to 20,000 discrete frequencies with accuracy of 0.0001% and zero error resetability. Synthesizer comes in three models, covering frequency ranges of 18 to 36 mc., 72 to 144 mc., and 215 to



410 mc., and can be operated by unskilled personnel.

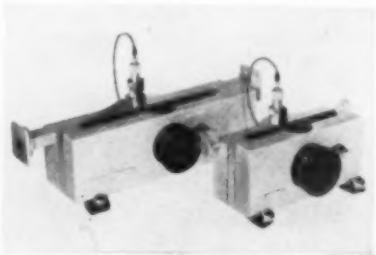
Application data is available in Bulletin 182. Manson Laboratories, 207 Greenwich Ave., Stamford, Conn.

ACCURACY!
Each month, hundreds of Whittaker gyros are used in the missiles which are so vital to our nation's defense. Accuracy in this project is of critical importance. Whittaker gyros meet these requirements with a rejection rate of less than 2%. Whittaker Gyro will be pleased to place its experience and facilities at your disposal.
Whittaker Gyro
DIVISION OF TELECOMPUTING CORPORATION
VAN NUYS, CALIFORNIA
STANLEY 7-5511

• **Servoscope,** a combined multiple-signal generator and phase angle indicator, indicates phase angle with error of no more than 1 deg. Available signal outputs include sineusoidal modulation in a suppressed carrier envelope, sine

and square waves. A matched five-inch cathode ray indicator, available with the Servoscope, offers high stability. Servo Corp. of America, 20-20 Jericho Turnpike, New Hyde Park, L. I., N. Y.

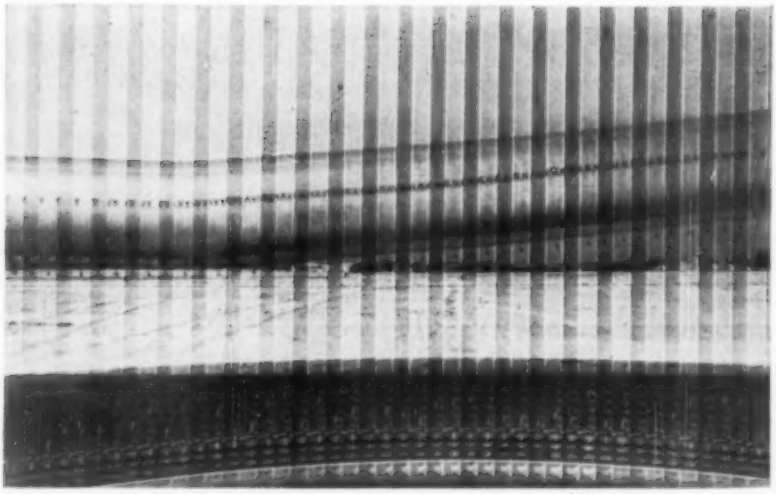
• **Standing wave detector,** for measuring bandwidth, covers range of 5.85 to 90 kmc. using two different carriages and nine different waveguide blocks and probes. A five-point carriage suspension



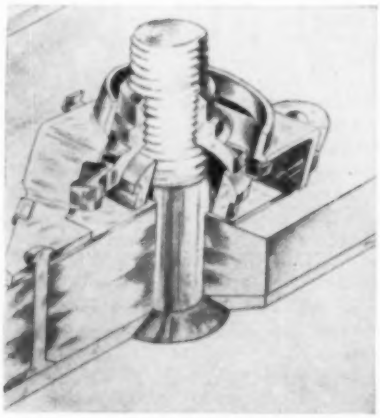
assures maximum linearity of probe motion and carriage speed can be varied over wide limits. DeMornay-Bonardi, 780 So. Arroyo Parkway, Pasadena, Calif.

High-Speed Recorder

New high-speed start-stop tape data recorder reportedly gets up to 60 in./sec. speed within six milliseconds, with tape speed fully stabilized to provide less than 0.1% rms. wow and flutter in less than 30 ms. Tape is 1 in. wide, can handle 14 channels, and has bandwidth of 300 to 100,000 cps. A-V Manufacturing Corp., 730 Fifth Ave., New York 19, N. Y.



What appears to be a king-size frankfurter is actually a sequence photo of Navy lighter-than-airship XZS2G-1 making a touch-and-go landing to check action of the single strut landing gear. Dual impact of the gondola mass and the airship body required special metering of the oleo strut's orifices. Picture was taken with a Flight Analyzer Camera made by Sherman Fairchild & Associates, (AW June 8, 1953, p. 55).



New Self-Aligning Nuts For Wing Assemblies

New, self-aligning nuts which allow wing skin to be assembled parallel to forged ribs without additional machining or shimming to compensate for wing taper or airfoil curvature are being placed in production by the Elastic Stop Nut Corp. of America.

Incorporation of the ball-joint principle in the assembly allows the self-aligning fastener to pick up bolts which are deflected as much as 8 deg. from centerline in any direction. A total float of .020 in. allows for bolt hole misalignment in any direction. The manufacturer cites these advantages:

• **Reduced assembly time** because time-consuming shimming is virtually eliminated. The self-aligning nut is installed as quickly as any ESNA anchor or gang channel nut.

• **Lower production costs** result from elimination of multi-dimensional flange milling and the complex machinery required to do such work.

Features of the nut include concave seat alloy steel nut body mating with an aluminum alloy swivel base to provide tilting and floating action. Lugs on nut body allows for self-wrenching. The ESNA LH offset, self-locking crown prevents bolt from loosening.

Labeled type 2822 self-aligning fastener, the nut meets spec AN-N-10. It meets the twist-out and push-out requirements of MIL-N-25027 (ASG).

Nuts will be manufactured in anchor nut (thread sizes 10-32, ¼-28, 5/16-24) and gang channel (thread sizes ¼-28, 5/16-24) types for both moderate and elevated temperatures.

High Speed Parachute

Van Nuys, Calif.—"Skysail," a parachute designed to allow bailouts at ultimate altitudes of today's aircraft and at transonic speeds, is under development for the U. S. Navy by Radioplane Co., a subsidiary of Northrop Aircraft.

Using knowledge gained in developing parachutes for target drone and guided missile recovery, Radioplane has devised a concentric cloth ring canopy assembled from specially shaped panel sections. Harness changes spreading the area of opening shock on the wearer are incorporated, as well as custom sizing the wearer and a parachute pack designed to be safe against inadvertant air blast opening when the wearer bails out. Tests are being conducted at El Centro Naval Air Station.

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- Electronics Engineers
- Electrical Engineers
- Hydraulics Engineers
- Weight Engineers
- Stress Engineers

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AIRCRAFT CORPORATION

P. O. BOX 2287
BIRMINGHAM, ALABAMA

CESSNA 620 FUSELAGE, which will have a specially designed AiResearch cabin pressurization unit has been fully load-tested.

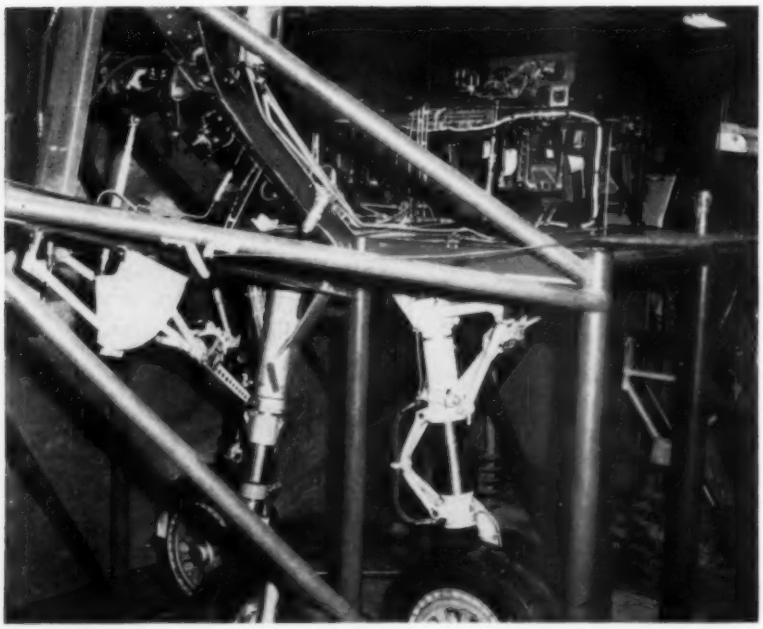
Cessna Completes 620 Tests, Prepares

Mating of major assemblies of Cessna Aircraft Co.'s prototype Model 620 four-engine pressurized business transport will begin within the next 30 days at Wichita, Kan., following the successful completion of more than a year's detailed testing of various components and systems.

The new Cessna, carrying a price tag somewhere within the $300,000 range, will seat from seven to 10 passengers.

Company officials last week declined to name a specific flight date for the new transport, emphasizing that it is not a rush project. The most definite statement came from Cessna president Dwane Wallace who would say only that the airplane will be airborne "in the near future."

Aside from the company's normally conservative approach on all of its new aircraft, an important factor is the proving and installation of much new equipment. This includes Continental's 320-hp. geared and supercharged GSO526 powerplants, which will provide 290 maximum continuous horsepower, and the specially designed AiResearch gas turbine cabin pressurization unit, which also provides heating and air conditioning on the ground as well as aloft.



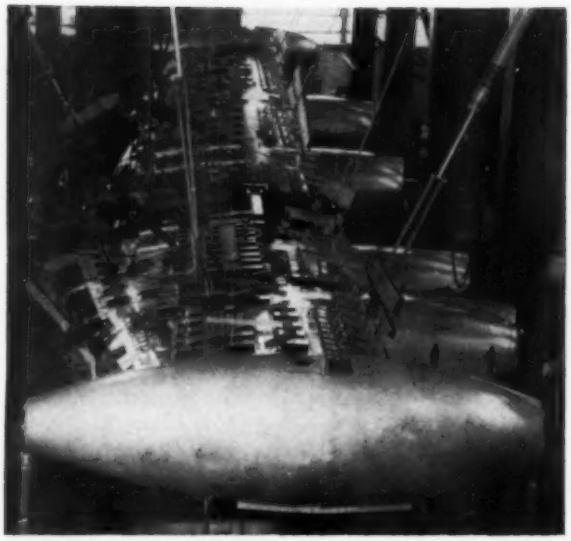
LANDING GEAR MOCKUP (nose gear in center) has undergone 4,500 complete test cycles.

Structural tests, considerably exceeding Civil Aeronautics Administration requirements, already have been completed on the tail surfaces, nose gear, fuselage and pressurized section. The tricycle landing gear, the hydraulic and electrical systems and other components have undergone complete functional tests including 4,500 cycles of operation. The wing is now in the final phases of testing and assembly.

An engine and nacelle mockup has been tested outdoors for a year and a half in co-operation with Continental. Trials include engine and propeller endurance and vibration surveys.

Preliminary design specifications for the 620 indicate that it will cruise at 233 mph. at 18,000 ft. on 70% cruise power and will have a top speed of 269 mph. at 15,000 ft. It will have an allowance of approximately 275 lb. for navigation and communications gear to be located in airline-type racks aft of the cockpit.

Fuel capacity exceeding 400 gallons will be located in wingtip tanks and outer wing panel bladder tanks; no fuel



WING (left) fitted with tip tanks and engine nacelles, nears end of tests. Engine and cowl mockup (right) is tested outdoors.

Assembly

will be stored between the inboard engines and the fuselage. An additional safety feature is location of 62% of the airplane's entire gross weight below the passenger compartment.

Cessna Ships 283 Planes in March

Business and utility aircraft industry delivered nearly 600 airplanes in February valued at more than $8.5 million compared with 532 aircraft worth just over $8 million the previous month (box, right).

Cessna maintained its lead in net billings and number of planes delivered, the AVIATION WEEK survey shows, shipping 283 aircraft valued at over $3.2 million. Beech topped Piper in billings, $2.4 million plus compared with the latter's slightly over $2 million. Plane deliveries were 67 and 214 respectively.

The Cessna lead is expected to take a further jump as deliveries mount on its new Model 182 with tricycle landing gear—some 100 of these airplanes were to be turned out in March. Advent of the 182 will probably effect output of its tailwheel-type sistership, the 180, just as the 172 has overtaken the 170.

Emergence of newcomers, such as Champion—producing a modernized version of the Aeronca Champion—Helio and Royal Aircraft Corp., is helping to swell the deliveries. If the current pace of deliveries is maintained, it is apparent that this year the industry will deliver well over 6,000 aircraft.

U. S. BUSINESS & UTILITY AIRCRAFT SHIPMENTS

(Jan.-Feb. 1956)

	Aircraft		Builder's Net Billing Price	
	Feb.	Jan.	Feb.	Jan.
Aero Design 560-A	7	9	$417,200	$670,500
Beech Bonanza	47	37	2,425,096	1,807,600
Super 18	7	6		
Twin-Bonanza	13	8		
Callair A-5A	0	0	11,008	0
A-4	4	0		
Camair 480 Twin-Navion	3	4	103,000	166,000
Cessna 170	6	20	3,242,710.58	2,859,342.20
172	150	132		
180	105	75		
310	22	21		
Champion	12	12	53,000	59,500
Helio H-391B Courier	2	3	46,000	69,000
Lear Learstar Mk. 1	0	1	0	400,000
Mooney Model 20	1	5	11,402.50	50,137
Piper				
Super Cub	71	57	2,061,916.65	1,815,474
Tri-Pacer	104	105		
Apache	39	32		
Royal Royal Gull P-136L	2	2	149,000	149,000
Taylorcraft				
Tourist A15A	0	0	9,585.80	27,568
Model 20	1	3		
Totals	596	532	$8,529,919.53	$8,074,121.20

Source: Compiled by AVIATION WEEK from manufacturer's reports. Note: Cessna supplied retail price for January shipments (AW Mar. 19, p. 63); corrected data is listed above.

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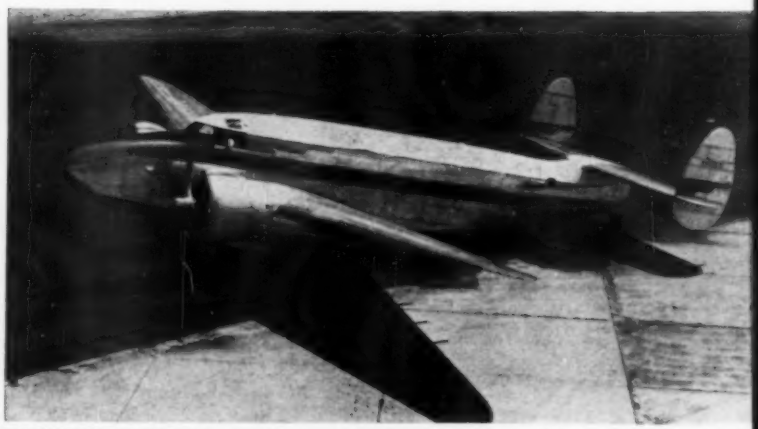


CONVERTED HUDSON executive transport has lost all resemblance to former bomb

Surplus Lockheed Hudsons Used As Lodestar-Conversion Source

A new source for Lockheed Lodestar executive transports has opened up through an extensive conversion of World War II surplus Lockheed Hudson bombers to L 18-56 configuration by Gordon B. Hamilton & Co., Tucson, Ariz.

First of the converted Hudson Mk. 3s was scheduled to be delivered in March to Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.

Hamilton has purchased five Hudsons from Arctic Airlines, where they had been used for aerial survey and photography work in Canada. The aircraft incorporate the heavier structure of late-model Hudsons similar to the late-model Lodestars and were approved for military operations up to 23,500 lb.

6,000-lb. Payload

Hamilton, whose conversion provides a Lodestar weighing 11,100 lb. empty, hopes to hold interior and radio weight to 2,400 lb., which would give the plane a 6,000-lb. payload including full fuel load and 10 passengers. The Giddings & Lewis Lodestar will have dual airline-type omni, dual marker beacon, dual automatic direction finders, 50-watt VHF transceiver and a high-fidelity sound system.

Hamilton's Lodestars are powered by Wright R1820-72W engines delivering 1,350 hp. on takeoff with Hamilton Standard 33D50 propellers. During Civil Aeronautics Administration flight tests, the airplane indicated 218 knots at METO power at 8,000 ft. Normal cruise speed has been 186 knots at 10,000 ft. with 31.5-in. manifold pressure and 2,150 rpm. Under normal power, the airplane reportedly has reached a true airspeed of approximately 228 knots at 10,000 ft., standard temperature, at a gross weight of 17,000 lb.

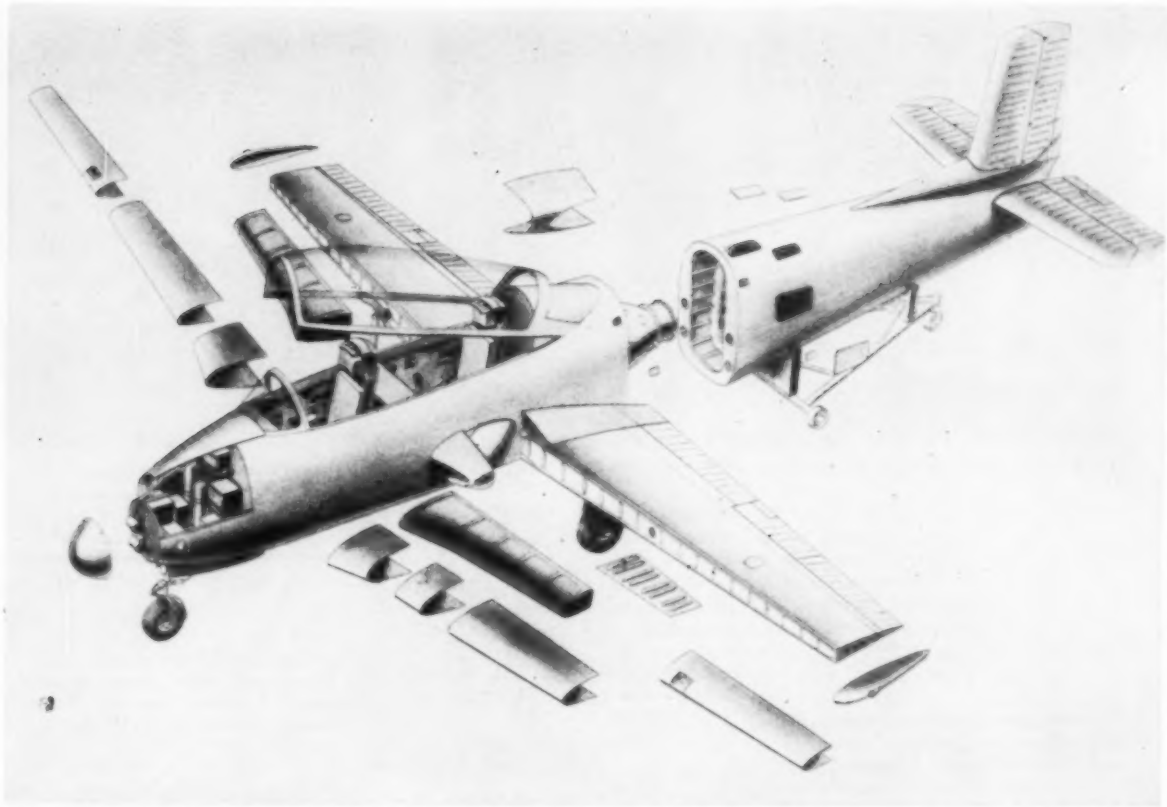
Rebuilding the Hudsons had to be accomplished via a licensing agreement with Lockheed since Hamilton is using aircraft parts applicable to the Lodestar and building a new plane assembled from these parts in addition to the other structural and aerodynamic considerations involved. CAA advised the conversion center that the Hudson was unairworthy for civilian use and could not be licensed; therefore a complete revision to Lodestar configuration was necessary.

Longer Fuselage

Gordon B. Hamilton, president of the conversion service, was a Lockheed representative detailed to the various Lodestar military versions and was familiar with its initiation. He pointed out that the first Lodestars actually were Lockheed 14s which Lockheed took off the production line, adding 66 in. to the fuselage at station 251. Other changes included raising the horizontal tail 12 in. and adding trailing edge wing extensions, sometimes called "batwings," to improve the airflow across the tail area.

His conversion maintains a maximum fuselage depth at Station 147, as on the Model 14, rather than at Station 19 as on the Lodestar. Hamilton's engineers believe the Lodestar's extra 1½-in. depth at this station may be responsible for the need for trailing edge wing extensions to correct the aircraft's tendency to porpoise. If so, the condition probably is marginal, because it does not exist after the removal of the batwings, according to Hamilton. Removal of these wing sections increases Lodestar cruise speed by approximately 10 mph.

Prototype Hudson-to-Lodestar conversion was completed early last December and granted a CAA airworthiness certificate under standard categor



EASE OF MAINTENANCE of new Beech 73 jet trainer is indicated in exploded view showing how components separate from airframe.

Beech Grooms New Jet Trainer for Tour

Beech Aircraft Corp. by last week had completed a major portion of the flight test program on its Model 73 two-place jet trainer and had formulated plans to send the aircraft from the company's Wichita, Kan., factory on a demonstration tour of U.S. military bases.

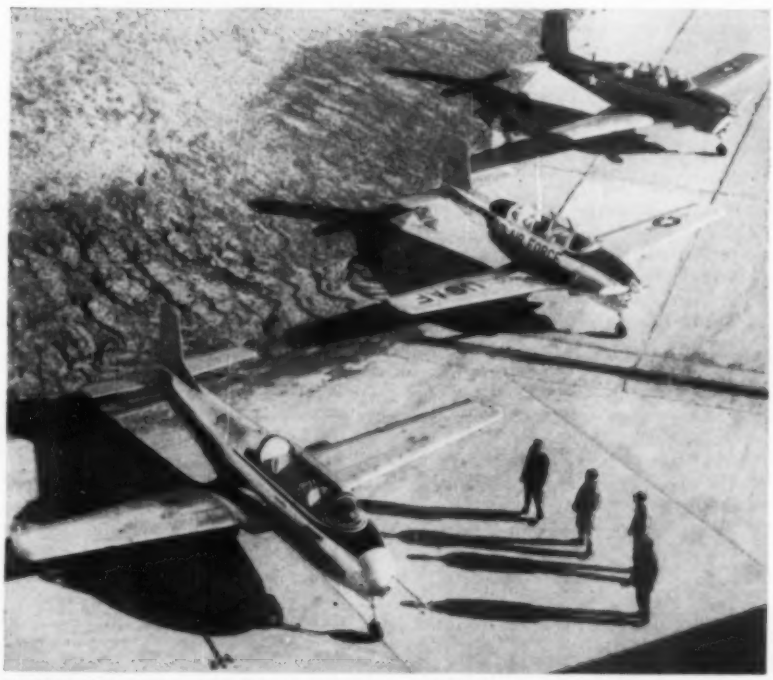
Indications are that Navy test pilots will get the first chance to check the trainer's characteristics when the tour begins within the next few weeks. Pilots of the Air Force, Navy and Army already have flown the plane from the factory site. The Royal Canadian Air Force also has indicated interest in the new trainer.

The company has completed Model 73 stability and performance flight checks. Remaining are structural-demonstration and cruise-control trials. The prototype has been flown over 100 hours during approximately 125 flights since its initial takeoff last December 18.

Phase 1 Tests

Phase 1 flight trials included:

• **Spin tests** in which the aircraft was spun up to 105 turns in one day with as many as 11 turns in one test. Spin



SIMILARITY of jet trainer (left) to piston-powered T-34 predecessors is evident.

CLAM-SHELL CANOPY covering both cockpits is power-actuated. Beech has tested lightweight ejection seats should customer want them.

trials ran eight days, and pilot reports indicate recovery was normal using standard technique. Spins were made with and without ejection seats and at all center-of-gravity configurations. Inverted spins were included in this phase.

• **Stability trials** were successfully made covering longitudinal, lateral and directional phases.

• **Performance checks** included flying the airplane at speeds exceeding 288 mph. and at altitudes exceeding 24,000 ft. The airplane was flown at over its maximum gross weight of 4,521 lb. Endurance trials indicate that the Model 73 has a range of 2.15 hours carrying 180 gal. of fuel.

Speed brakes have been installed on the trainer's wings. Flight tests reports say they have effected rapid deceleration with no pitch change or buffeting even at 345 mph. The airplane also has been flown in an inverted position for a full minute at normal power without causing engine flameout or drop in oil pressure.

Structural Trials

The structural demonstration trials will include symmetrical and rolling pullouts at six G's at 356 knots. Dives and pullouts will be made at maximum speeds.

The company emphasizes that they envision the Model 73 as a military trainer and that they are not considering any civilian-market sales.

Designed as a jet replacement for the piston-powered Beech T-34 Mentor, now the standard primary trainer for USAF, Navy and numerous foreign governments, the Model 73 embodies many T-34 characteristics and uses many of its components.

Powerplant is a single Continental J69-T-9, an improved version of the French Turbomeca Marbore II, delivering approximately 920 lb. thrust, installed aft of the rear cockpit and accessible by "breaking" the fuselage just forward of the trailing edges of the wings. Rear fuselage can be separated in eight minutes.

The Model 73 has approximately the same dimensions as the T-34. It measures 32-ft. 9-in. span, is 30-ft. 2-in. long and is 9-ft. 11-in. high. Empty weight is 2,925 lb. It is designed for an ultimate load of 11.25G's.

High speed at 15,000 ft. is 295 mph. and cruise speed is 245 mph. Dive speed is 500 mph. Rate of climb is stated to be 1,400 fpm.

There are two bladder-type fuel cells in each wing connected to a central sump. Fuel gaging system is of a capacitance type. Other equipment includes electrically operated trim tabs operated from the control stick, a one-piece clam-shell type power-operated cockpit canopy and a nickle-clad battery that eliminates the need for an auxiliary ground-type starter.

PRIVATE LINES

Purchase of Mid States Manufacturing Co., Pittsburg, Kan. by Helio Aircraft Corp., Norwood, Mass., is expected to be announced soon. Mid States has been producing the four-place Courier business plane under license from Helio (AW Aug. 22, 1955, p. 81).

First Super Aero Commander 680 delivery was made late in March by Aero Design & Engineering Corp., Oklahoma City, to Long Manufacturing Co., Tarboro, N. C.

Curtiss OX-5 Jenny World War I trainer, said to be in good condition except for fabric, is offered for sale by Robert R. Pfeil, 201 W. 4th, Taylor, Tex.

Cessna Gives New 182 Fast Buildup

Production of the new Cessna 182 four-place business plane, a tricycle gear development of the 180, has been speeded up since initial output of about 40 planes in February to some 100 aircraft in March. Output will be stabilized at seven planes per working day. Priced at $13,750, the 182 cruises at over 158 mph. on 70% power. Powerplant is a 230-hp. Continental 0470-L. Deliveries are being made concurrently with nationwide showings at distributors to end this month. The tricycle 182 complements the new tricycle 172 to round out the company's 1956 line.

CAB Report on Executive-Plane Crash

Fuel-Tank Explosion Downs Private A-26

At 2117,[1] October 3, 1955, a Douglas A-26C, N 67148, owned and operated by the Great Lakes Carbon Corporation, crashed two miles northwest of Union City, Oklahoma, following structural failure resulting from a midair explosion.

All four occupants, Captain Joseph W. Whitney, First Officer John E. McBride, and passengers Mr. and Mrs. George Skakel, Sr., received fatal injuries. The aircraft was destroyed by impact and ground fire.

On October 3, 1955, the Douglas A-26C, N 67148, departed its home base, Bridgeport, Connecticut, at 1245 with a crew only, consisting of Captain Joseph W. Whitney and First Officer John E. McBride. A stop was made at White Plains, New York, to pick up a passenger, Mrs. George Skakel, Sr. The flight then proceeded to LaGuardia Field where Mr. George Skakel, Sr., an official of Great Lakes Carbon Corporation, boarded the aircraft.

N 67148 departed LaGuardia at 1346 for Tulsa, Oklahoma, under Visual Flight Rules and no flight plan was filed. After landing at Tulsa the aircraft was refueled with 906 gallons of gasoline which filled to capacity both main tanks, the nose tank and the rear fuselage tank. Both auxiliary tanks were full at the time of refueling.

After the pilots were briefed by the Tulsa U. S. Weather Bureau office, an Instrument Flight Rules flight plan was filed with the Air Route Traffic Center specifying the following: Cruising altitude 8,000 feet, Victor Airway 14 to Oklahoma City, Oklahoma, Red Airway 24, Victor Airway 12 proceed direct to Banning, California, Victor Airway 16 to Los Angeles; airspeed 260 knots; time of departure 2038; en route time 5 hours and 15 minutes; alternate—Burbank, California Airport; fuel on board—7 hours. At the time of departure at 2038 Tulsa had a 9,000-foot ceiling with visibility of 6 miles and light rain.

At 2114 Oklahoma City Airway Communications Station received a call from N 67148 on 126.7 mcs. requesting cancellation of the IFR flight plan and asking for a landing clearance at Oklahoma City. The communicator gave the flight the Oklahoma City special 2100 weather as 10,000 feet overcast, sky partially obscured; fog; visibility 1½ miles. The flight was advised to contact RAPCON (Radar Approach Control) on 119.3 mcs. for a clearance to land as IFR conditions prevailed. The crew was requested to advise which airport clearance was desired for and the reply was "Will Rogers Field."

This was the last radio contact with the flight although subsequent attempts to contact it were made by RAPCON.

At approximately 2117 an aircraft, later identified as N 67148, was observed to crash on a farm 2½ miles northwest of Union City, Oklahoma, and 23 miles west of Will Rogers Feld, Oklahoma City. Two explosions were heard in the air prior to the crash and portions of the empennage and fuselage were found along the last three miles . . .

[1] All times herein are Central Standard and are based on the 24-hour clock.

INVESTIGATION

Witnesses several miles north of the crash site, who observed the aircraft several hundred feet above the ground, describe two distinct flashes in its descent to the ground. They also mention a light rain at the time but no lightning.

Examination of the wreckage and ground marks indicated that the aircraft, minus the aft fuselage and tail assembly, had dived to the ground, in an inverted attitude at nose-down angle of approximately 45 degrees on a southeasterly heading.

Disintegration in flight was indicated by numerous segments of the fuselage shell and portions of the horizontal stabilizer skin being found back along the flight path as far as three miles from the main wreckage. The main portion of the empennage was found three-eights of a mile from the main wreckage. All of the scattered portions of fuselage structure were from the area aft of the cabin rear bulkhead.

Examination of these parts gave evidence of internal explosive forces that had blown the skin outward or off and distorted the structure of all empennage components except the rudder and the elevators. There were no indications of heat damage or fatigue in the aft fuselage wreckage which could have resulted in failure under loads less than design.

There was no compression buckling of the skin and stringers, characteristic of failures due to overload. However, there were numerous indications of the aft fuselage shell having disintegrated because of excessive tensile stresses throughout the entire shell acting both longitudinally and peripherally at the same time.

The fuselage disintegrated along rivet seams, which are areas of least tensile strength, evidencing a practically uniform internal pressure throughout the aft portion of the fuselage. The aircraft was not equipped for cabin pressurization.

No evidence was disclosed to suggest failure or malfunctioning of the engines or propellers prior to impact.

Examination revealed scorched edges at the torn holes in the rudder fabric. Blistered paint was likewise noted at the trailing edge of the left elevator. The source of this flame damage was not associated with the ground fire.

Destruction of the aircraft forward of the cabin aft bulkhead by ground fire was extensive. Major components, including wings, flaps, ailerons, nose and cockpit areas, controls, instruments, fuel tanks, landing gear, nacelles, etc., were all accounted for in the area adjacent to the point of impact. Examination disclosed that the wing flaps and the landing gear were in the retracted position at the time of impact.

Only the following instrument readings were obtainble; Omni Bearing Selector 232 degrees; Radio Magnetic Indicator—double pointer 240 degrees, single pointer (ADF) 198 degrees; Zero Reader Selector 240 degrees; C2 Gyro Compass 246 degrees.

A 125-gallon fuel tank and radio rack were installed in the aft fuselage without a vapor seal separating the two units. The severe fire damage after ground impact precluded a determination of the condition of the fuel system components prior to the accident. The aft fuselage fuel tank vent line was found with its end fittings failed from excessive tension. It was established that the aft fuselage tank was filled to capacity at the time of departure from Tulsa. The Tulsa fuel attendant stated the tank was not overfilled at the time of servicing.

In the tail section of the fuselage, aft of the rear cabin bulkhead, in addition to the 125-gallon fuel tank, there was installed the following electrical equipment: (2) ARN-7 compass; (2) loop antenna; (1) MN53B marker receiver; (1) ARN5A glide path receiver; (1) RTA-1B command unit; (1) A-12 gyrosyn repeater amplifier; (2) Collins 51R, (2) Collins 17L-2 VHF transmitter; (2) inverters; (1) isolation amplifier; (1) R-89B glide path and (1) BC733D localizer.

A study of the aircraft records revealed no pertinent discrepancies. The most recent airframe 100-hour inspection was dated September 8, 1955, and the aircraft had flown 14 hours since that time. This inspection covered the security of the interior equipment, such as tank, radio, all lines, cables and A-12 servos of the empennage and tail compartment. The last line inspection (at LaGuardia on October 3, 1955) revealed no discrepancies.

After the accident a flight check of the ground navigational facilities involved in an approach to Oklahoma City disclosed normal operation of all units.

Aero Trades, Inc., CAA Approved Repair Station No. 115, MacArthur Airport, Ronkonkoma, New York, modified the aircraft for passenger carrying. The aircraft was then certificated by the Civil Aeronautics Administration in the limited category which prohibits the carrying of passengers for hire.

Their work, accomplished in accordance with Forms ACA 337 (CAA Repair and Alteration Form) dated April 4, 1951, and April 9, 1951, included the following item: No. 15. Installed Army type 125-gallon fuel tank in aft section of fuselage (original installation).

According to records of the Great Lakes Carbon Corporation Aviation Department, all Air Force Technical Orders for the A-26 had been received and compliance had been accomplished.

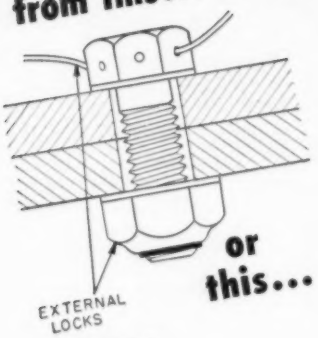
ANALYSIS

Facts determined by investigation disclosed that the tail surfaces and fuselage aft

How to Do Away With Lock Nuts and Lock Wiring

use HELI-COIL* Screw-Lock Inserts

from this...



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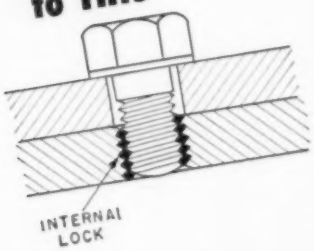

Screw-Lock Inserts meet AN-N-5b and MIL-N-25027 military specifications for lock nuts.

For years designs requiring lock nuts or lock wiring have plagued designers with problems of space, weight and costs. Each lock nut, even a small one, takes space, has weight and costs money. Every bolt locked with wire requires a through hole in the head, positioning and wiring. The simplicity of many a superior design has been lost due to these cumbersome methods of fastening.

Now for the first time good designers can do away with these "design plaguers." They can accomplish the same end results plus a saving of weight, space and money by a new revolutionary concept in fasteners—*Heli-Coil* Mid-Grip Screw-Lock Inserts. This new fastener is a stainless steel wire insert with locking threads. It can be installed easily and puts the locking effect *inside* the tapped hole—protects the tapped threads for life—and locks the mating screw or the bolt with the same torque as a lock nut. This Screw-Lock Insert not only provides a stainless steel protecting thread, locks the screw or bolt, but most important of all—eliminates the space and weight of a lock nut—the wiring necessary in lock wiring.

Heli-Coil Mid-Grip Screw-Lock Inserts can readily be distinguished from regular non-locking *Heli-Coil* Inserts by their distinctive red color.

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IN CANADA: W. R. WATKINS CO. LTD., 41 Kipling Ave. S, Toronto 18, Ont.

of the bulkhead at the rear end of the cabin separated from the airplane in flight.

The manner in which the skin bulged outward and separated from the horizontal stabilizers and bulged outward on the fin could result only from very high internal pressures. It is apparent that the pressures which caused the disintegration built up suddenly and that they originated in the aft fuselage. Only an explosion within the aft fuselage could cause a sudden pressure increase of this nature.

Explosions from concentrated sources, such as sticks of dynamite or containers of TNT, produce severe shattering and fragmentation close to the source of explosion with decreasing fragmentation as distance from the source increases. This type of explosion also leaves soot-like deposits on the structure shattered. Neither of these characteristics was present in this case.

Fuel Fume Ignition

Instead, the fuselage disintegration indicated a particularly uniform pressure such as is caused by the ignition of an air-gasoline mixture which is much slower than the detonation of high explosives. In addition, this latter type of explosion does not leave deposits on the structure.

The Board therefore concludes that fumes caused by leaking fuel were ignited by operation of electrical equipment installed in the aft fuselage.

The scorched fabric and blistered paint on the tail control surfaces appear to have been caused by momentary burning of fuel which spurted out of the aft fuselage tank after the first explosion disrupted the fuel lines. This fuel drenched the tail surfaces while the tail assembly was still attached to the main part of the aircraft by means of control cables.

This same fuel was probably ignited by sparks from disrupted wires of the electrical equipment in the aft fuselage which could well account for the second explosion described by ground witnesses.

The nature of the accident and the fact that all communications from the flight were routine and conducted in a normal tone of voice indicate that the pilots were unaware of an immediate emergency. The reason for discontinuing the flight to California and the decision to land at Oklahoma City could not be determined.

CAB Recommendation

As a result of the investigation the Board recommended to the Civil Aeronautics Administration that all owners and operators of A-26B and A-26C aircraft be immediately advised of the possible fire and explosion hazards inherent in similar installations and that corrective action be taken immediately.

Accordingly, the following notification was forwarded to all Aviation Safety District Offices, and to all owners of this model aircraft: "Investigation recent A-26 accident indicates possible fire and explosion hazard in rear fuselage area. For all A-26B and A-26C aircraft having rear fuselage tank installed in same compartment with electrical components liable to sparking the following restriction is mandatory until further notice: Rear fuselage fuel tank shall be drained, purged, and marked to prohibit use. Placard cockpit fuel controls and filler

cap for information pilot and servicing personnel."

This notice was followed by AD 55-26-1 which specifies modifications for reactivation of the rear fuselage tank.

FINDINGS

On the basis of all available evidence the Board finds that:

1. Both pilots and the aircraft were currently certificated.
2. The load of the aircraft was within gross weight limits and was properly distributed.
3. Weather was not a factor in the accident.
4. There was no evidence to indicate failure or malfunctioning of the engines or propellers.
5. Both a fuel tank and miscellaneous electrical equipment were installed in the aft fuselage.
6. The aft fuselage tank was filled to capacity shortly before the accident.
7. The fuel system components in the aft fuselage were not separated adequately from the electrical equipment by a fume-tight seal.
8. Fumes from gasoline in the aft fuselage pervaded the interior of the horizontal stabilizer and vertical fin.
9. The inflight ignition of the explosive fuel-air mixture and resultant pressure surge in the aft fuselage caused structural failure.
10. Following the accident immediate corrective action was taken by the Civil Aeronautics Board and Civil Aeronautics Administration.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was the loss of the aircraft's empennage as a result of an inflight fuel explosion in the aft section of the fuselage.

By the Civil Aeronautics Board:

Ross Rizley
Joseph P. Adams
Chan Gurney
Harmar D. Denny

SUPPLEMENTAL DATA

The Civil Aeronautics Board was notified of this accident at 0700 October 4, 1955. An investigation was immediately started in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended.

Aircraft Operator

The Great Lakes Carbon Corporation, 18 East 48th Street, New York, New York, purchased their first aircraft in 1946. They presently own and operate, in addition to the subject A-26, two Douglas DC-3s and two Cessna 180s.

These aircraft, used to transport company personnel to numerous points in the United States, Canada, Mexico and the Caribbean area, flew a total of 10,797 hours from 1946 to 1955.

Flight Personnel

• **Captain Joseph Warren Whitney,** age 34, held a currently effective airline transport pilot certificate with an appropriate rating

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HUGHES
FALCON

Research and Development at Tucson

The Hughes Research and Development Laboratories have now been extended to Tucson, Arizona, where the deadly air-to-air Falcon is presently being produced for the U. S. Air Force and Canadian continental defense interceptors.

This is in line with a long-range program that includes application of the Hughes Falcon to more and more types of military aircraft.

ENGINEERS
PHYSICISTS

New positions are being created in fields of specialization covering the complete range of structural, hydraulic, electronic, and electromechanical engineering. Experimental, analytical, or design abilities will be required of those who work in these areas.

Scientific Staff Relations

HUGHES

RESEARCH AND DEVELOPMENT LABORATORIES

TUCSON, ARIZONA

for the subject aircraft. He was employed as a captain July 26, 1952.

Captain Whitney had accumulated approximately 11,500 pilot hours, of which 900 were in A-26 type aircraft. His last physical examination was on September 30, 1955. He passed a captain's and an instrument check on September 29, 1955.

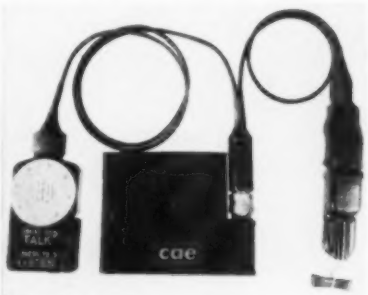
• **First Officer John E. McBride,** age 31, held a currently effective airline transport pilot certificate with appropriate ratings. He was employed temporarily for sixty days in 1953, and permanently by the company on April 1, 1955.

Mr. McBride had accumulated approximately 2,544 pilot hours, of which approximately 500 were in the type equipment involved.

He passed his last physical examination in April 1955 and his last instrument check on Septemebr 29, 1955.

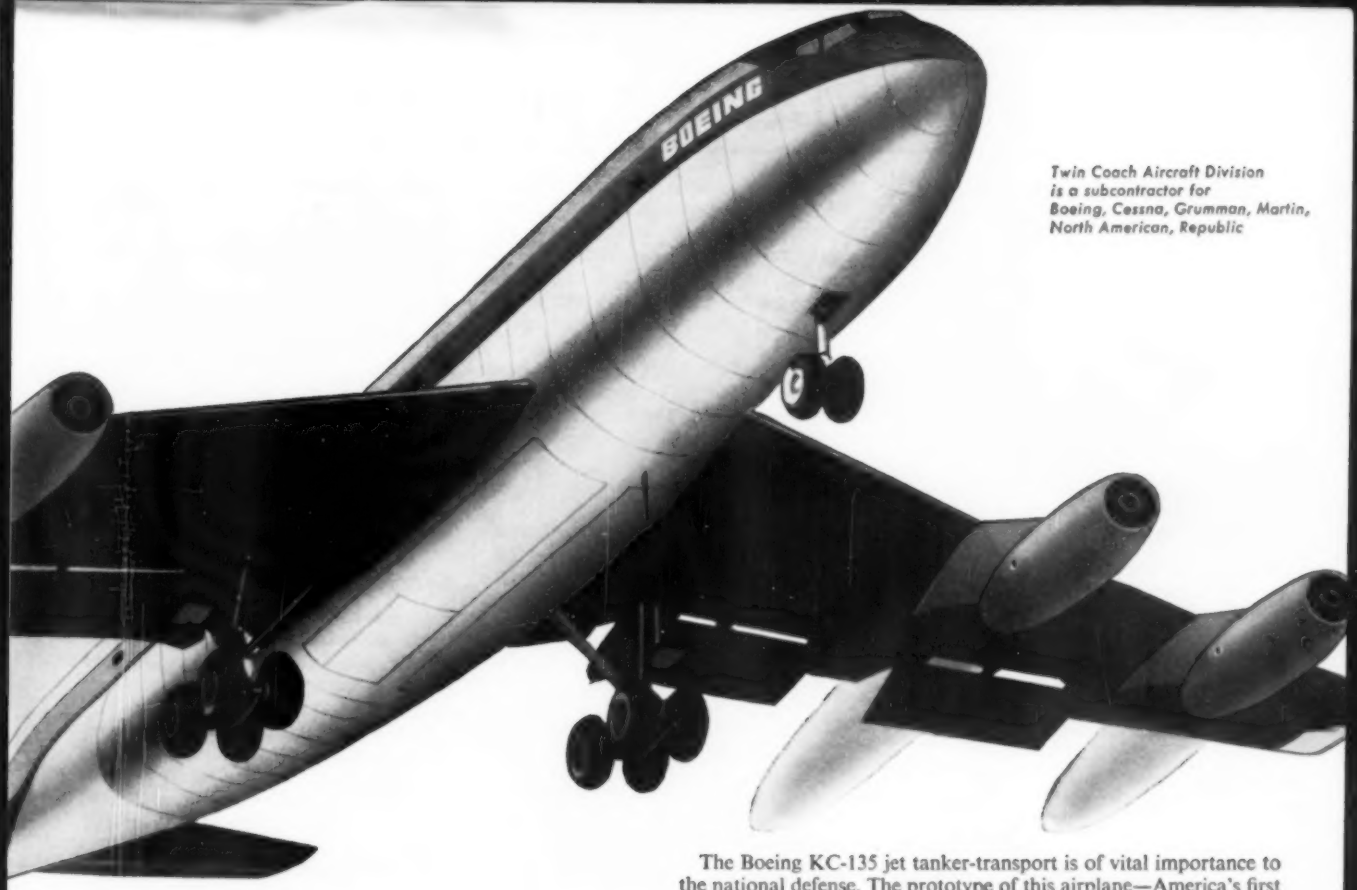
The Douglas A-26C (limited), N 67148, bore manufacturer's serial number 29229 and was built in 1945 for the U. S. Air Force. It was purchased by Great Lakes Carbon Corporation July 26, 1950, and modified for passenger carrying in April 1951. Total airframe time as of September 28, 1955, was 2,183 hours with 14 hours since the last 100-hour inspection.

The aircraft was equipped with Pratt and Whitney model R2800-27M1 engines and Hamilton Standard model 23E50 propellers. Time on the engines and propellers since overhaul was 122 hours. Time on the engines since the last 100-hour inspection on August 11, 1955, was 48 hours.



RCAF's SARAH

This type of Sarah (Search, Rescue and Homing) unit has been adopted by the Royal Canadian Air Force to facilitate locating and rescuing lost or downed airmen. The subminiaturized avionic package weighs 3½ lb. and is carried in a pilot's jacket pocket. It enables one plane to locate survivors in a 30,000 square mile area in four hours, in spite of snow, fog or night, according to Canadian Aviation Electronics, Ltd. who stock, service and distribute the equipment in Canada. The two-way radio is designed to survive the most rugged treatment. It also may be used as an inner or outer beacon transmitter or as a marker to locate air-dropped cargo. CAE is also developing, from the Sarah principle, a position indicator which operates automatically if a plane crashes. Shown above are (left to right), speech unit, battery and transmitter. Address: P. O. Box 630, Station "O," Ville St., Laurent, P. Q., Canada.



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Twin Coach helps Boeing get them in the air

Sooner

The Boeing KC-135 jet tanker-transport is of vital importance to the national defense. The prototype of this airplane—America's first jet transport—is shown above. To produce and deliver KC-135s to the Air Force as rapidly as possible, Boeing enlisted the aid of Twin Coach Aircraft Division as a subcontractor for major airframe assemblies.

This important assignment typifies the way prime contractors rely on Twin Coach Aircraft Division. For Twin is staffed with experienced aircraft specialists to design and build tooling . . . with experienced aircraft production personnel . . . under experienced aircraft supervision and management.

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AA-1431

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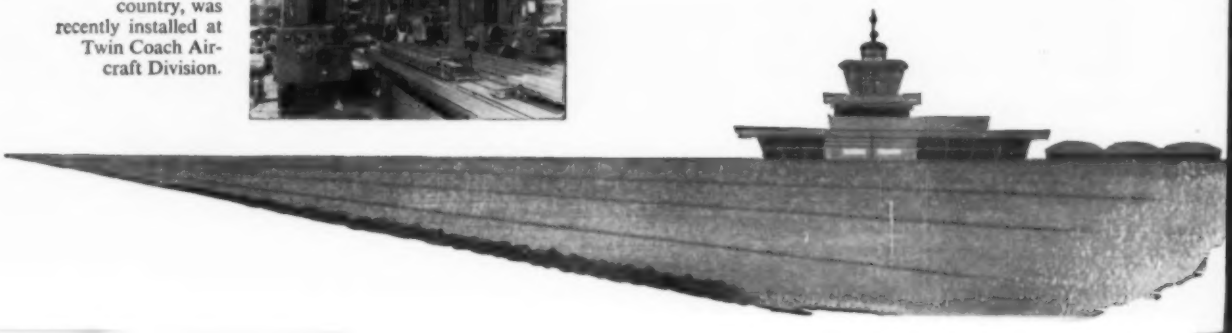
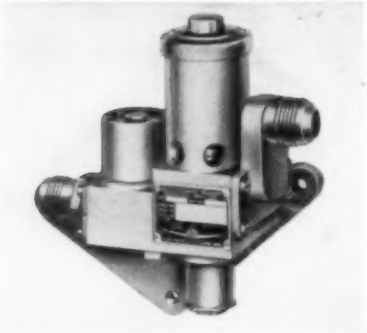


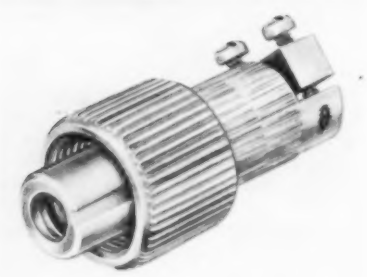
NEW AVIATION PRODUCTS



Valve for Anti-G Suits

Fully automatic pressure-regulating valve for use with anti-G suits weighs less than two pounds and requires no manual setting. Inlet pressures range from 10 to 300 psi. Temperatures from −65 F to + 400 F are permissible.

Alar Products, Inc., 1071 Power Ave., Cleveland 14, Ohio.

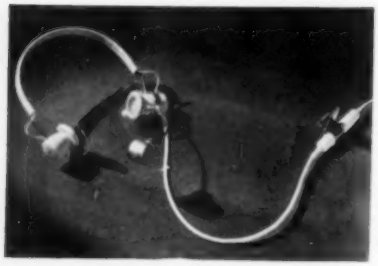


High-Temperature Connector

High-temperature connector GHR1F-1H is especially designed for installation on aircraft fire detection systems and for missile applications.

Unit is said to be capable of handling temperatures of up to 2,000 F.

Gorn Electric Co., Inc., Electronic Division, Stamford, Conn.



Headset Weighs 7 Oz.

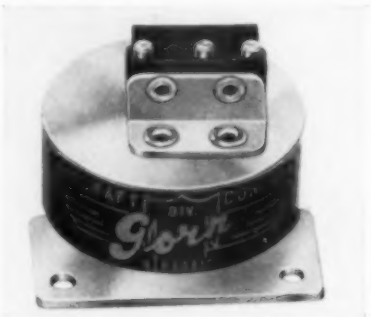
Series 2566 headphone/microphone sets weigh approximately seven ounces complete with microphone. Headphones are made of molded plastic parts fitted to adjustable sliding extensions on a flat stainless steel covered headband. Insert units are acoustically equalized to provide a response level from 200 cps. to 3.3 kc./s ±3 db.

Units have been placed into service at London Airport and are now standard for all British airports under Ministry of Transport & Civil Aviation jurisdiction.

Amplivox Ltd., Industrial Products Division, 2 Bentinck St., London, W.1.

Miniature Altitude Switch

Model GB-300 miniature barometric pressure switch for fast automatic control of aircraft electric or electronic units can be pre-calibrated to open or



close a circuit at any altitude from 1,000 to 50,000 ft. with a small differential.

Unit weighs 1.75 to 2 ounces.

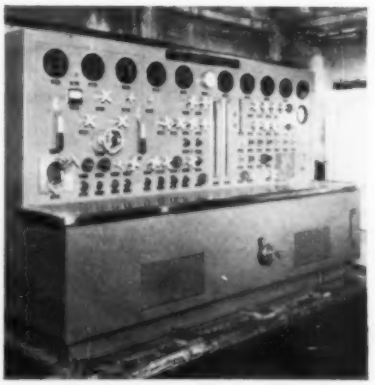
Gorn Electric Co., Inc., Aircraft Control Division, Stamford, Conn.

Armament Control Unit

A hermetically-sealed armament control box automatically schedules correct sequences of door opening, rocket-launcher extension and other related functions of a firing mission.

Current rating of five amp. is available. Box is made of aluminum and measures 5 in. wide x 5.5 in. long and 3.5 in. deep. Weight is four pounds.

Electronic Specialty Co., Dept AC, 5121 San Fernando Rd., Los Angeles 39, Calif.



Hydraulic Test Bench

Hydraulic test bench, designed especially for Lockheed Aircraft's Missile Division, produces variable fluid-flow up to 20 gpm. with a working pressure of 3,000 psi. Supplemental pumping unit will produce fixed volume pressures up to 5,000 psi. An additional independent air-oil booster pump system pushes static testing pressures to 10,000 psi. Each pressure system is individually gaged.

Designated Model 54-720, the unit has controls to automatically compensate for different types of fluids, temperature extremes, variations in fluid viscosities, pressures and flows.

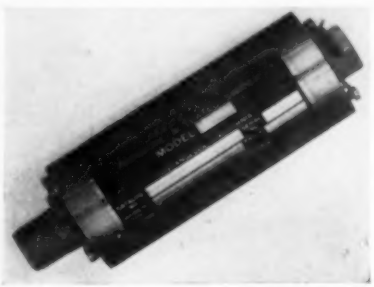
Rucker Co., 4700 San Pablo Ave., Oakland, Calif.

Pressure Switch for Jets

Model 1400 pressure switch, featuring no-leak tier-tube design, is specifically designed for jet engine use and other applications where vibration and temperature are factors.

It can be used for fuel, oil, pneumatic and hydraulic applications. Unit employs either an aluminum or stainless steel actuator, with present range of 400F and projected design up to 600F. One moving part is used; there are no seals, springs or linkages.

Model 1400A is for pressures up to 800 psi. proof and weighs 0.36 lb. Model 1400S to 5,000 psi. proof weighs



This is a cam characterized potentiometer, one of several in Honeywell's advanced MB-3 Autopilot. By scheduling circuit gains as functions of the basic flight control parameters, these Honeywell-made precision potentiometers help make the aircraft behave at supersonic speeds. The pilot gets the aeronautical equivalent of power steering: he applies the same stick force for a given maneuver, regardless of the aircraft's speed or altitude.

AERONAUTICAL DIVISION, MINNEAPOLIS-HONEYWELL

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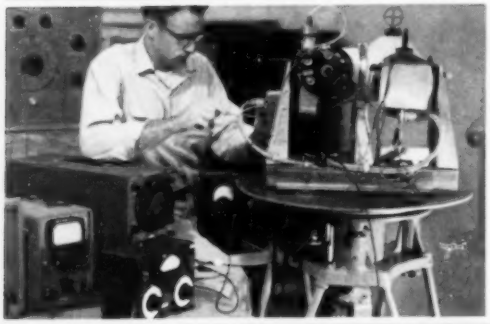

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Instrumentation laboratory

At Ramo-Wooldridge today there exists a wide range of projects intended to aid aircraft in navigating to the vicinity of targets, finding the targets, destroying them, and returning safely to base. Work is under way in such fields as infrared and microwave detection, information display, communication and navigation, and analog and digital computing. Some projects are in the laboratory development stage, some in the flight test stage, some in pilot production.

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0.65 lb. Switch body is 3.5 in. long and diameter is 1.5 in.

Meletron Corp., 950 N. Highland Ave., Los Angeles 38, Calif.

Mount for Heavy Cameras

Heavy-duty camera mount for precision adjustment of elevation and azimuth can handle units such as Mitchell, Fastex, Maurer, Bell & Howell and large photo-instrumentation and data-recorders.

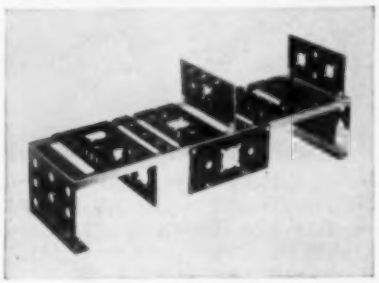
A feature is a locking method allowing the camera to be removed from the mount and later replaced in its exact former position without disturbing the bore-sighting.

Gordon Enterprises, N. Hollywood, Calif.

ALSO ON THE MARKET

Metering valve, single-stage torque motor-driven, converts an electrical signal to a straight-line gradient response for either hydraulic signal or pneumatic applications. Operational pressure is 0 to 1,500 psi.—National Water Lift Co., 2220 Palmer Ave., Kalamazoo, Mich.

Chassis kit for construction of equipment prototype models uses plastic mounting boards to provide low dielectric losses and insulation resistance. Steel sides and end brackets are rust-



proofed by cadmium plating; silver-plated solder terminal lugs are lacquered. Unit is 5 in. wide x 16⅞ in. long x 3.5 in. high.—Precision Metal Products Co., 41 Elm St., Stoneham 80, Mass.

Duodyne headset produces a "live" effect of sound transmission by inducing a five millisecond delay in sound to one earpiece. Unit weighs 5 oz. and has a frequency response of 100 to 8,000 cps. and impedance of 15 ohms.—Telex, Inc., Telex Park, St. Paul 1, Minn.

Miniature d.c. planetary geared motor with brake, designated Model 1700-1, has an output of 1 lb. in. Voltage is 25-29-v. d.c. normally, current is 400 amp., stopping angle of output shaft is

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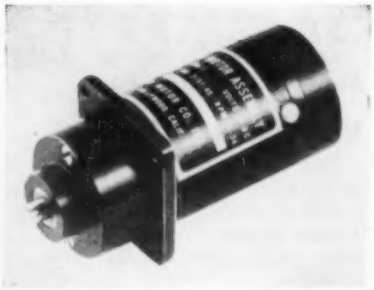

three degrees maximum; unit is 2 in. long from mounting flange; weight is 7.5 lb.–El Ray Motor Co., Inc., 11747 Vose St., N. Hollywood, Calif.

Portable temperature test chamber, Model TC-2A, is designed for production line tests of small products. Model includes new anticipator-type thermostat, which provides extremely accurate temperature control; three-heat selection switch; welded aluminum construction and glass-fiber insulation.–Statham Development Corp., 12411 W. Olympic Blvd., Los Angeles 64, Calif.

Small solenoid toggle switch CQ-31 is designed for systems requiring a visual "on-off" indication. Basically it consists of a miniature micro-type switch actuated by a toggle held in position by

a solenoid-operated detent. Unit is environmentally sealed.–Eclipse-Pioneer Division, Bendix Aviation Corp., Teterboro, N. J.

Profile miller has a table of 48 x 120 in., width between columns of 60 in. and distance between table and spindle of 21 in. Unit is available in tables from 48 x 48 in. in increments of 2 ft. up to 144 in. Power feeds are available with speeds up to 320 in., for transverse movement, vertical tracing, 360-deg. tracing or three-dimensional tracing systems.–Morey Machinery Co., Inc., 383 Lafayette St., New York 3, N. Y.

MD-2 capacitor-type fuel quantity gage tank unit tester combines a servo-operated self-balancing three-terminal capacitance bridge and an accurate megohm meter. The bridge is specifically designed to measure capacitance to values of 5,000 uuf. in three ranges in increments as low as 0.1 uuf. Accu-

racy is said to be better than 0.5% of full scale.–Telectro Industries Corp., 35-18 37th St., Long Island City 1, N. Y.

Precision snap switch is 1⅜ in. long x ⅜ in. thick and 7/16 in. wide. TyniSwitch is fully enclosed and has only one moving part. Units are available in four basic designs varying in operating force from three to 12 ounces in pin-operated models and from 1.5 to 12 grams in wire-operated models.–Detroit Controls Corp., TyniSwitch Department, 800 Union Ave., Bridgeport, Conn.

Toggle switch with "electric memory" is a four-pole assembly with one pole for indicating which circuit was last operated. Designated 21AT, unit is designed for positive actuation and to

prevent false signals or operation from partial movement of the toggle lever.–Micro-Switch Division, Minneapolis-Honeywell Regulator Co., Freeport, Ill.

Load cells electrically measure forces and weights up to 10,000 lb. in compression. Units are less than 2 in. in diameter and only 2.75 in. high overall. Calibration accuracy is stated to be ± ¼% of full range at any load at 70F. Resistance across power terminals is 120 ohms.–Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.

Electronic micrometer can be used by unskilled personnel to check up to 3,500 pieces/hour at tolerances less than 0.0001. Minitron has an electronic adjustment enabling inspector to establish any magnification from 10,000 and 1,000.–Industrial Guages Corp., EAM Division, Englewood, N. J.

W227 mount is applicable to damping low-frequency vibration common to laboratory and industrial equipment. Designed for a static load deflection of 2.5 in., unit is said to have vibration isolation capacity of 85% and better at 6 cps. and over.–Robinson Aviation, Inc., Teterboro, N. J.

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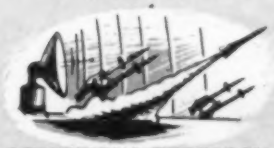
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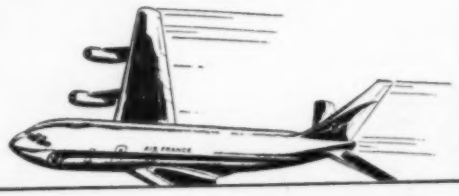

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AIRLINER FLEETS to fly with Pratt & Whitney Engines

Douglas DC-8s and Boeing 707s with Pratt & Whitney Aircraft JT3 and JT4 jet engines ordered by additional U. S. and foreign airlines. Four more U. S. and foreign operators have placed quantity orders for jet airliners powered with Pratt & Whitney Aircraft jet engines. They are Continental Air Lines, Air France, Sabena, and Panagra, making a total of eleven airlines which have taken this important step toward the jet air age. Still more orders are expected.

Orders for jet airliners with Pratt & Whitney engines were placed previously by Pan American World Airways, United Air Lines, National Airlines, American Airlines, KLM Royal Dutch Airlines, Braniff International Airways, and Eastern Air Lines.

Both the Boeing 707 and the Douglas DC-8 which have been purchased by these leading airlines have been designed to fly with the world's most powerful jet engine in quantity production, the JT3, and its advanced version, the JT4. Both of these Pratt & Whitney Aircraft engines are of twin spool, axial-flow design. The JT3's military counterpart, the famed J-57, has flown since 1953 in record-breaking fighters and bombers, and has accumulated thousands of hours in the air with outstanding dependability.

Pratt & Whitney engines have spurred many advances through aviation history. The Wasp, the Hornet, the Twin Wasp, the Double Wasp and the Wasp Major have led the way since the mid-1920s. Now the JT3 and JT4 will supply the power for the world's finest *jet* airliners, introducing the age of jet travel.

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North Atlantic Air Cargo Hits New Peak

Record 29 million lbs. of air cargo crosses North Atlantic in 1955; prospects even better for '56.

By Glenn Garrison

Scheduled U.S. and foreign airlines moved a record 29 million lbs. of cargo over the North Atlantic during 1955, an AVIATION WEEK survey disclosed last week, and all signs point to an even busier, more profitable 1956. Reasons behind the optimistic outlook for a bullish, competitive 1956 include:

- **Stepped-up schedules.**
- **New cargo promotion** programs and cargo facilities.
- **Revised rate structure.**
- **All-cargo airline's** scheduled entry into the North Atlantic operations.

Cargo traffic during the first months of this year, according to airline reports, already is running well ahead of last year's. Pan American, for example, reports a 61% gain this January over last.

New York Focal Point

The fact that no real transatlantic cargo airplane is now in service or likely to be within the near future, of course, postpones the full development of this market.

About 90% of the North Atlantic traffic moves through New York, the balance mostly through Montreal, with a relative trickle through Boston, Philadelphia and Baltimore.

During the coming summer season at New York, 13 U.S. and foreign flag airlines will offer 246 combination flights each week, plus 11 all-cargo flights.

In addition, the all-cargo Seaboard and Western Airlines will cash in on its new certificate to operate on a scheduled basis. Seaboard, after delays because of foreign government negotiations, plans to get going within the next two weeks.

Why the Rise

North Atlantic air cargo traffic through New York has almost doubled in the five years since 1951. Total for that year was about 15.5 million pounds. The figure rose steadily to about 20 million in 1954, and then went sharply upward last year to approximately 27 million pounds.

The increasing number of airliners moving across the Atlantic is one reason for the jump in cargo totals. It is not the only reason, however. Transatlantic aircraft movements and passenger totals through New York rose about 20% in 1955, leaving a 15% spread in the air cargo increase. (The number of 1955 passengers was about 685,000; movements about 27,500.)

Most of the airlines feel last year's tariff revisions, with simplified classifications and generally lower rates (AW July 25, 1955, p. 121) are a factor in the booming transatlantic business—but none of them consider the present structure as anywhere near the ultimate. "A step in the right direction" sums up the opinion expressed almost unanimously by airline officials in describing the tariff changes.

Sales Programs

There are some further reservations. One foreign carrier suggests that, with the decreased rates, 40% more volume will be needed to bring in the same revenue.

Another factor is the intensified cargo sales programs some of the carriers are accomplishing.

With almost everyone agreed that the business will be there in increasing quantities, the airlines are out to make sure they get their share.

Two additional aids to the transatlantic cargo business are the Civil Aeronautics Board's encouragement of air freight forwarders (AW Sept. 9, 1955, p. 16), and the simplification of some U. S. Customs procedures involving air shipments.

The entry of Seaboard and Western into the scheduled field has not caused any apparent panic among the other carriers despite their efforts to block the airline's certification.

Of the transatlantic cargo big three —Pan American, KLM Royal Dutch and Trans World—the two U. S. airlines say Seaboard's operation under an "equalized" rate structure will be an asset.

KLM says it is "glad they're in," because the Dutch line feels Seaboard will develop new business that should be of benefit to all.

New Idlewild Facilities

Seaboard, which says its rates "by and large were always comparable" to those of the scheduled carriers, agrees it will be going after new business rather than that of the other carriers.

All the carriers plan to move their cargo operations into the new $5.5 million facilities now under construction at New York International Airport. These will consist of four new air cargo buildings and one "cargo service" building containing freight forwarding, federal inspection, a warehouse and other units.

All are scheduled for completion this year.

Originally three cargo buildings were planned, but demand for space was so great that the fourth was added—another indication of the general confidence in the air cargo future.

During 1955, the foreign-flag airlines serving New York carried more than 14.4 million lbs. of cargo, as compared with 12,624,116 lbs. for the two American carriers on the transatlantic run, although Pan American and TWA carried more than half of the passenger traffic.

Also during the year, cargo imports continued to exceed exports through New York—some 15 million lbs. went eastward by air, as compared with 12 million lbs. coming into this country.

Breakdown by Airlines

A further breakdown of how the airlines serving New York fit into the transatlantic cargo picture, with figures supplied by the airlines, shows:

- **Pan American,** carrier of about one-fourth the cargo total last year—some 7 million lbs.—expects another 35% increase this year (last year's increase was 46% over that of 1954) and reports doubled cargo advertising and a 30% increase in its sales staff for 1956.

Pan American's summer schedules total 75 weekly combination flights each way, plus six all-cargo schedules.

- **KLM Royal Dutch Airlines** ran second carrying a total of 6 million lbs., (up 18% from 1954) across the Atlantic.

The Dutch carrier, expecting a record volume in 1956, is developing its sales program in the U.S., with a new development manager to coordinate its sales efforts throughout the country. It also has consolidated its New York cargo sales office and cargo terminal.

KLM's summer schedule totals 21 combination and three all-cargo flights from New York each week.

- **Trans World,** third in the picture with a 1955 total of 5,624,116 lbs., expects a relatively modest 4.6% increase in its transatlantic cargo traffic this year, the same as last year's increase over 1954. TWA summer schedules

New York-Europe Cargo Traffic 1955

	1955 Revenue Cargo (Lbs.)	Increase Over 1954	Summer 1956 Weekly Flights	
			Combination	All-Cargo
Air France	949,451	43%	19	
BOAC	1,854,861	2%	16	
El Al Israel	159,966	95%	4	
Iberia	64,896	102%	2	
KLM	6,000,000	18%	21	3
LAI	300,000	60%	7	
Loftleider	80,000	50%	5	
Lufthansa	54,000	(Began Service June, 1955)	9	
Pan American	7,000,000	46%	75	6
Sabena		11.7%	10	
SAS	2,250,000	37%	21	
Swissair	1,400,000	59%	7	1
TWA	5,624,116	4.6%	50	1
TOTAL	25,737,290		246	11

from New York: 50 combination and one all-cargo flights per week.

• **Scandinavian Airlines System** carried 2,250,000 lbs., last year, up 37%, and expects a similar increase in 1956. The airline is increasing its promotion efforts at points outside of New York and reports a 1955 shift from 80% to 50% of its cargo originating in the New York area. Summer schedules: 21 combination flights weekly.

• **British Overseas Airways, Corp.** carried about 1.7 million lbs. in 1955, up 2%. The airline says "the boom in cargo will continue," looks to an increase in business through a pool arrangement with South African Airways. Summer schedules: 16 combination flights weekly.

• **Swissair** carried 1.4 million lbs., up 59%, and expects a 50% increase this year. The airline offers one weekly all-cargo flight in addition to seven combination flights for the summer season, expects to add a second all-cargo schedule this year.

• **Air France** lifted 949,451 lbs., a 43% increase, and expects the total to continue rising. Weekly schedules will be advanced to 19 combination flights for the summer.

• **Sabena Belgian World Airlines'** 1955 total was up 11.7% in terms of ton-kilometers (25 million), but weight figures were unavailable. Summer schedules: 10 combination flights.

• **Deutsche Lufthansa,** which began transatlantic operation last June, carried a gnat's share of the 1955 cargo total—about 54,000 pounds—but has aggressive plans for the future. The West German airline has opened a new cargo office in New York, recently acquired sales representatives around the country and hopes to schedule an all-cargo flight once a week out of New York sometime this year. Meanwhile, New York summer schedules total nine combination flights.

• **Linee Aeree Italiane** carried 300,000 lbs. in 1955, up 60%, and will offer seven weekly combination flights this summer.

• **El Al Israel's** 1955 total was up 95% to 159,966 lbs.; summer schedules, four with a possible increase to five.

• **Iberia of Spain** reported 1955 total was up 102% to 64,896; summer schedules, two.

• **Loftleider Icelandic** airlines carried 80,000 pounds in 1955, up 50% and will fly five flights a week this summer.

CAB Order Sets Limits On Seven States Case

Washington—The complex Seven States Area Investigation has moved a step closer to public hearings with a Civil Aeronautics Board order which sorts out dozens of applications and sets the limits of the case.

The Board has decided to limit the case to consideration of local air service and has limited the area of the case to St. Louis and Kansas City on the South, Denver and Williston, N. D., on the West, and Chicago in the East.

The Seven States Case was instituted last December when the Board decided to act on petitions filed by a group of states for service in North Dakota, South Dakota, Nebraska, Iowa, Illinois, Wisconsin and Minnesota. The CAB consolidated the Quad Cities-Twin Cities Service Case with the new investigation.

In limiting the case the CAB rejected applications for trunk service filed by Capital Airlines, Delta Air Lines and Eastern Air Lines. Also excluded were applications for service to Canadian points.

Included in the case is an investigation to determine whether the CAB should suspend Braniff Airways at St. Joseph, Mo., and Rochester, Minn.; Western Air Lines at Chadron, Neb., and United Air Lines at Grand Island, North Platte and Scottsbluff, Neb., and Iowa City, Iowa.

The Board also consolidated a portion of the reopened Williston Basin Area Case to decide whether to substitute Frontier Airlines for Braniff at Minot, N. D.

When it decided to bar applications for service to states west of the Dakotas, the Board said it would set up a separate case to review local air service in the Pacific Northwest, including Montana, and assign it for prompt action.

The Seven States investigation will include applications filed by Frontier Airlines, Central Airlines, Ozark Air Lines, North Central Airlines, Braniff Airways, Western Air Lines and 50 communities and organizations.

Air Traffic Controllers Seeking New Members

Washington—The newly formed Air Traffic Control Association (ATCA) kicks off a national membership drive this week. Six categories of membership have been proposed: professional, member, corporation, student, associate and honorary.

Proposed annual dues range from $12 for professional status to $3 for associates. ATCA is the first professional organization for the air traffic controller. Bulk of the membership is expected to come from the Civil Aeronautics Administration, U. S. Air Force and Navy. First solicitations for ATCA membership have gone out to CAA personnel at more than 600 tower, center and communication facilities.

A national meeting of regional representatives was scheduled for Mar. 31 to adopt a constitution and by-laws and elect officers. Clifford P. Burton has been appointed executive director (AW Mar. 19, p. 25) and Oswald Ryan was named general counsel. Burton was formerly chief, Airways Operations Division of CAA, and Ryan was a 16-year member of the Civil Aeronautics Board. ATCA is currently using the following address: c/o Butler Aviation, Hangar 9, National Airport, Washington 1, D. C.

The formation of a professional society for air traffic controllers has been strongly supported by both government and industry. Secretary of Commerce Sinclair Weeks endorses ATCA. The Air Line Pilots Assn., Aircraft Owners and Pilots Assn., and the Air Transport Assn. also have expressed interest.

Chicago Traffic Is Shifting to O'Hare

By Preble Staver

Chicago—Scheduled airline service at the new O'Hare International Airport, which has had little more than token traffic since its official opening last Oct. 31, will be increased substantially by Apr. 29.

Airlines now scheduling some operations at O'Hare include American, Delta, Northwest, TWA, United and two all-cargo carriers—Slick and Riddle. Traffic has been averaging 80 flights a day. United leads with 26, followed by Slick with 20 and American with 18.

This month Braniff, Capital, Eastern and North Central Airlines will begin service at O'Hare. On Apr. 4 Capital will introduce four inbound and four outbound flights daily, including one Viscount service. The big influx of scheduled flights doesn't begin, however, until the end of the month, to coincide with the annual shift to daylight saving time.

The next expansion of service is anticipated by early summer, according to Ralph Heinze, airport supervisor at O'Hare. By June, he said, the second major runway of 8,000-ft. is to be commissioned. It will run in a NW-SE direction and paralled the existing major runway, which is 7,350 feet long.

None Too Soon

Heinze expects that all the airlines now serving Chicago eventually will use O'Hare. This includes 14 domestic and four foreign airlines.

O'Hare's availability as a second Chicago airport has not come any too soon. The city's Midway Airport, long the busiest commercial airfield in the world, now handles a traffic volume far in excess of normal, safe capacity. In 1955 Midway's capacity was stretched to handle 381,737 aircraft movements and a total of 8,600,000 passengers.

So far O'Hare hasn't served its purpose—alleviating the congestion at Midway.

Fewer scheduled airline operations have been put into O'Hare than have been added at Midway in the same time.

One major reason why the airlines have not increased their services at O'Hare before now is the absence of adequate dining facilities. This will be rectified next month when Marshall Field & Co. opens a $300,000 restaurant and cocktail lounge in the main terminal.

Educating Passengers

Another problem that must be solved by the airlines is passenger education. The great majority of Chicago's air travelers are not familiar with or accustom to going to O'Hare. They are in the habit of going to Midway, where more service is scheduled, and not until O'Hare's services are increased will the trend reverse itself. The big job of selling O'Hare to the public will be made through a joint effort of the airlines and airport management.

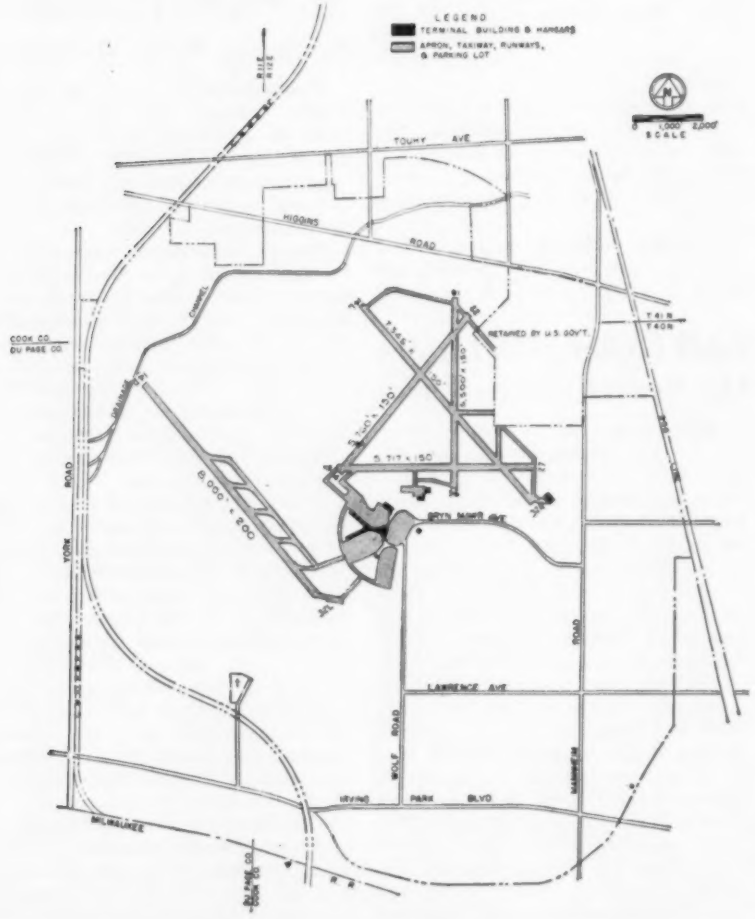
The initial plan for full utilization of O'Hare's present facilities is to transfer approximately 30% of Midway's traffic to the new field. This means cutting back operations at Midway to a fixed capacity of six million passengers annually, George DeMent, Chicago's Commissioner of Public Works, told AVIATION WEEK. DeMent said such a traffic load can be handled conveniently and safely at Midway and should never be exceeded. O'Hare will absorb Chicago's continually growing air traffic, he said—particularly jet transports.

O'Hare is ready now to accommodate three million passengers annually and can be expanded readily as the air traffic increases in the years to come, DeMent said.

Second-Stage Plans

To date, O'Hare represents total expenditures of $21.5 million, of which the City of Chicago put up $10 million, the state of Illinois another $4.5 million and the federal government $7 million. Ultimately total costs will exceed $100 million to provide facilities for an estimated passenger traffic of 16.5 million a year by 1975. This is in addition to the six million at Midway.

Next stage in the progressive development of O'Hare's 6,000-acre area—which



O'HARE RUNWAY LAYOUT shows situation as it stands today. The 8,000-ft. runway 14R-32L (at left) will be commissioned this summer and provide a dual-runway operation.

PRESENT PLAN of O'Hare terminal area which will be expanded to accommodate 24-million passengers annually, with 100 gate positions, six major runways in three dual set-ups.

incidently is 10 times greater than Midway's—is construction of the second of five main terminal areas, hangars, the second of six main runways and other facilities, at a cost of $35 million.

The major facilities now available at O'Hare include:

- **A two-level** terminal building with a transportation level on the ground floor and a passenger level on the second. The passenger concourse, with ticket counters, baggage, restaurant and concession areas, is an acre in size. The entire ceiling is lighted. (Five such terminal areas will be built eventually.)
- **A Y-finger** from the terminal provides 16 gate positions with room for four more. (A total of 100 gate positions is planned.)
- **Gasoline storage** tanks providing a capacity of 800,000 gallons with a truck fill stand system to serve aircraft.
- **A parking** lot for 1,400 autos adjacent to the terminal.
- **A modern** control tower fully equipped for operations with ILS, GCA and surveillance radar.
- **Apron areas,** taxiways and five runways including the new 8,000-ft. one.

These facilities have been handling an average of 10,000 aircraft movements monthly so far this year. In 1955 there were 142,912 operations at the field, of which 85,109 were military and 57,803 civilian and commercial of all types. The number of passengers handled at O'Hare totalled 114,693, with most of the traffic accounted for in November and December.

Military Operations

The military operations primarily consist of permanently based USAF interceptor squadrons and Air National Guard units. It is hoped that within the year the regular service jets will be transferred from O'Hare and future military operations can be held well below the maximum limit of 25% of the capacity of the field.

At present more than 100 private aircraft are permanently based on the field. The corporate aircraft fleet numbers about 35.

Fixed Base Operations

The fixed base operations at O'Hare are conducted by Skymotive, Inc., which has the only new hangar at the field immediately adjacent to the terminal.

O'Hare management is firm in its position that there will always be room for private and corporate flyers.

Since the field has been open to commercial operations, the landing fee has been a basic single price—20 cents per 1,000-lb. gross landing weight. This price is to remain in effect until July 1, 1957. Airline operators have guaranteed the airport a minimum of $480,000 for the 18-month period prior to the establishment of new landing fees.

The new charges beginning in mid-1957 will be determined from the cost of operating the field, including amortization of the city's investment less rental income and federal airport aid. Landing fees and other charges are to be reviewed annually. The airport fathers say the airlines are in a position to pay for the facilities they require.

Director of Airports

William Downs has been named director of airports for the City of Chicago. He will have charge of all airport activities at Midway, O'Hare and Meigs Field. Downs was appointed to the new Department of Public Works post by Mayor Richard Daley. He formerly was assistant administrative engineer in Public Works and will continue to report to George DeMent, Commissioner of Public Works.

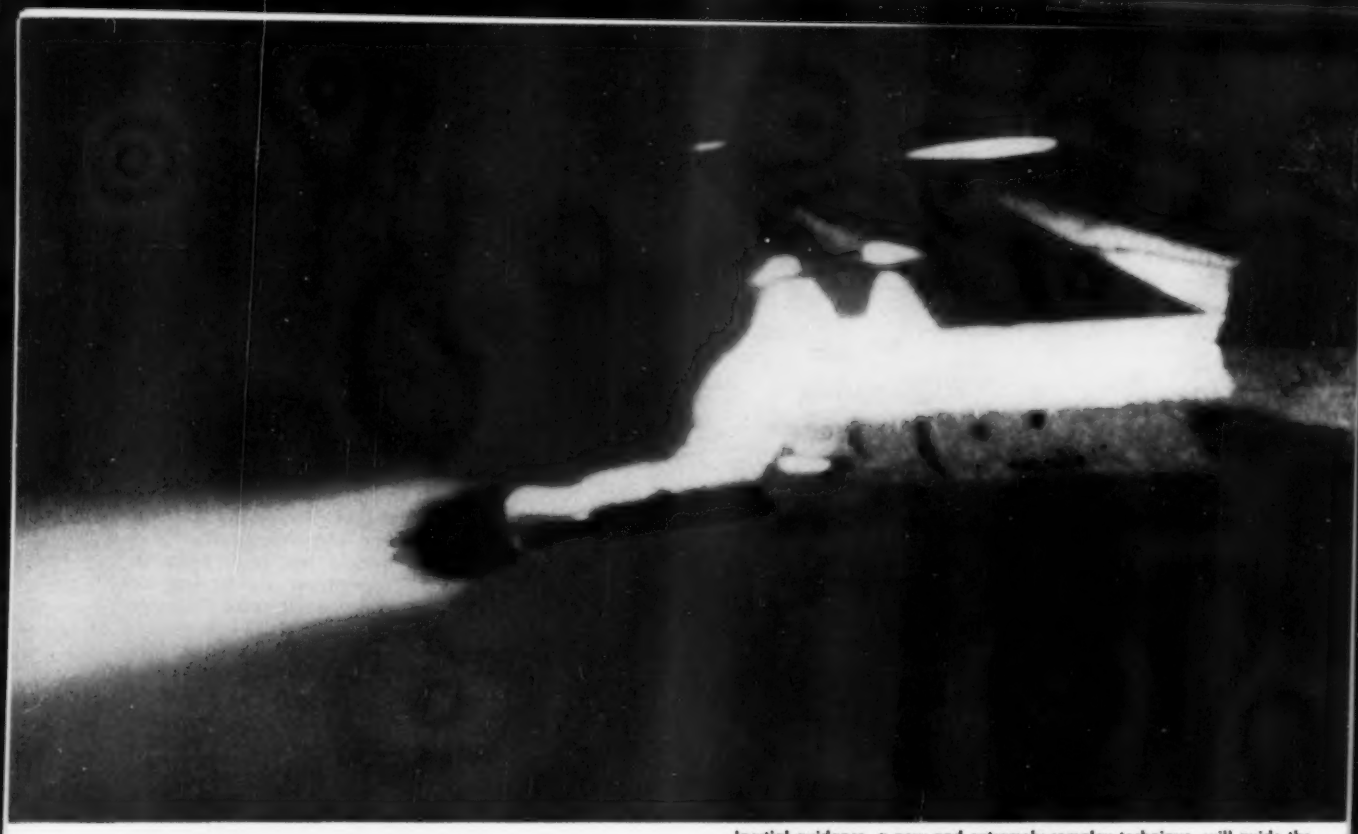
Crew Blamed by CAB In Fatal DC-4 Crash

Washington—The Civil Aeronautics Board has blamed the crash of a Flying Tiger Lines DC-4 on power failure from incorrect fuel system management and faulty restarting methods.

The accident occurred on the Honolulu-Wake Island leg of a transpacific military contract cargo flight. The DC-4 lost power in three engines and ditched in the ocean after restarting attempts proved futile. Two crew members survived a 30 hour wait for rescue. Two other crew members drowned awaiting rescue, and a fifth member went down with the aircraft, which sank almost immediately.

The engine power loss was due to fuel exhaustion, although the aircraft had sufficient fuel to reach Wake Island.

The CAB found that the power loss was due to positioning of fuel selectors on empty or nearly empty tanks. The report also found that the failure to restart the engines was due to incorrect technique or improper method of using fuel selectors and associated controls.



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Typical of AVIATION WEEK's staff of experienced engineer writers is Avionics Editor Philip J. Klass, author of the exclusive report on this new missile guidance system. Mr. Klass graduated in Electrical Engineering from Iowa State College in 1941, joined General Electric, and spent the next ten years in phases of GE's avionics activities including fire control, flight control, navigation, and instrumentation joining AVIATION WEEK in 1952. Mr. Klass is a member of the American Institute of Electrical Engineers Institute of Radio Engineers (member of IRE professional groups on Aeronautical and Navigational Electronics, Communications Systems, Electronic Computers, Radio Telemetry and Remote Control, Component Parts, and Management), Aviation Writers Association, and Delta Sigma Rho.

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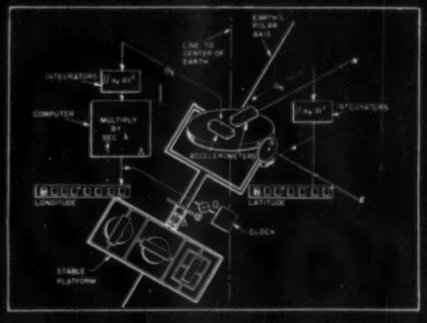

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CAB Studies Use of Simulators For Pilots' Proficiency Checks

Washington—The Civil Aeronautics Board this week will issue a draft release of a proposed Civil Air Regulations amendment that would permit airlines to use simulators in lieu of aircraft for semi-annual pilot proficiency checks.

CAB has been reviewing flight simulator utilization for some time at the industry's urging.

Last month in Denver, Oscar Bakke, deputy director of the Bureau of Safety Regulation, told the Airline Chief Pilots' meeting that CAB's proposed revision of the regulations could be looked for around the first of April.

The Civil Aeronautics Administration has shown similar interest in simulator use. Earlier this year CAB and CAA met with airline and pilot representatives to discuss future requirements.

Purpose of the meeting, called by E. B. Franklin, chief of CAA's Air Carrier Safety Division, was to consider what necessary features could be incorporated in synthetic training devices to make them acceptable as a substitute for actual flying. A list of minimum needs was compiled. It will be given industry circulation before being included in the regulations.

Airlines studying simulator purchases consider such a list essential. It will indicate the features needed for CAA approval and eliminate non-essential features, with a possible reduction in cost.

First carrier to ask CAB directly for greater recognition and acceptance of flight simulator training was United Air Lines. Now operating a primary fleet consisting of 68 DC-6s, 25 DC-7s and 55 Convair 340s and owning four Curtiss-Wright Dehmel Flight Simulators, United petitioned for exemption or waiver of the regulations to allow pilot proficiency checks by simulator.

United has had more experience with flight simulators than any other commercial air carrier. Two of the company's simulators, a Douglas DC-6B and a Convair CV-340, are located at Chicago. Denver also has one of each. All UAL flight crew members have received training in the simulators during the past 23 months, for a total of more than 17,000 hours. Currently, United is operating its simulators 12 hours a day, 7 days a week.

In view of this favorable experience, United has ordered three additional simulators—two more DC-6Bs and another CV-340. All are expected to be installed at Denver in September.

In addition to safety, comfort and efficiency, simulators offer economy.

Following is a comparison between current United's hourly operating costs with simulators and the related planes:

Airplanes		Simulators	
DC-6	$234.00	DC-6	$76.00
DC-7	361.00	DC-6	76.00
CV-340	188.00	CV-340	77.00

Another important factor is the substantial potential earnings of airplanes freed by using the simulators.

United estimates it could make the following gains in 1956 if it could use the additional simulators now on order, and if all proficiency checks could be given in simulators:

Basic flight engineer first officer training	$1,592,000.
Upgrading training	397,000
CV-340 transition training	14,800
DC-6 transition training	192,000
Proficiency Checks	230,000
Gross gain	$2,425,800
Less estimated of crew travel expense to and from Chicago and Denver	254,000
	$2,171,800

N. Y. Heliport Plan

Construction of a ground-level heliport at the foot of New York's West 30th Street has been recommended to the city's Board of Estimate by a committee of municipal engineers seeking a solution to the two-year hassle between New York's Department of Marine and Aviation and the Port of New York Authority (AW Feb. 27, p. 100). The engineers' report will be officially submitted within the next two weeks, and final action on the dispute should follow shortly.

While the recommendation favors the Port Authority bulkhead heliport proposal over Marine Commissioner Vincent A. G. O'Connor's rooftop plan, O'Connor said last week it also calls for extending the ground-level strip partly out over the water to move the helicopter landing area further from the West Side Highway. O'Connor has contended that proximity to the highway makes the bulkhead plan unsafe.

Alaska, Hawaii Lines Near Permanent Status

Washington—Civil Aeronautics Board endorsement appears to have cleared the way for early Congressional approval of legislation granting permanent certificates to intra-Alaska, states-Alaska, and intra-Hawaii carriers.

Both House and Senate Commerce committees held hearings last week. Witnesses—including Alaska's Gov. B. Frank Heintzleman, Alaska Delegate E. L. Bartlett and Hawaii Delegate Mrs. Joseph R. Farrington—emphasized permanent certificates were a "must" for long-range planning and the financing of new equipment and schedules.

CAB said "the economic conditions and other circumstances applicable to the local service carriers are also generally applicable to the Alaska and Hawaii carriers and . . . permanent certification is in the public interest."

Sen. Warren Magnuson (D.—Wash.), Senate Commerce chairman, noted that the developments anticipated when Congress authorized the permanent certification of the local service lines last year are materializing and "they are stepping up their schedules and buying new planes."

Carriers that would benefit by the legislation for permanent certification:

- **Alaska Airlines** and Pacific Northern Airlines, which operate from the Pacific Northwest to Alaska as well as intra-Alaska routes.
- **Northwest Airlines**, which now operates its Minneapolis-Alaska segment under a temporary certificate.
- **Trans-Pacific Airlines** which operates intra-Hawaiian routes.

(The other territorial carrier, Hawaiian Airlines, already has a permanent certificate.)

- **Numerous intra-Alaska** carriers operating some route segments under temporary certificates. Reeve Aleutian Airways is the only carrier totally on a temporary basis.

Pan American World Airways, which already has permanent certificates for its operations to Hawaii and Alaska, states that it is taking no position on the legislation, which would give competitors permanent status. The only opposition expressed was by Commerce Department, which maintained that permanent certification should be left to the discretion of CAB.

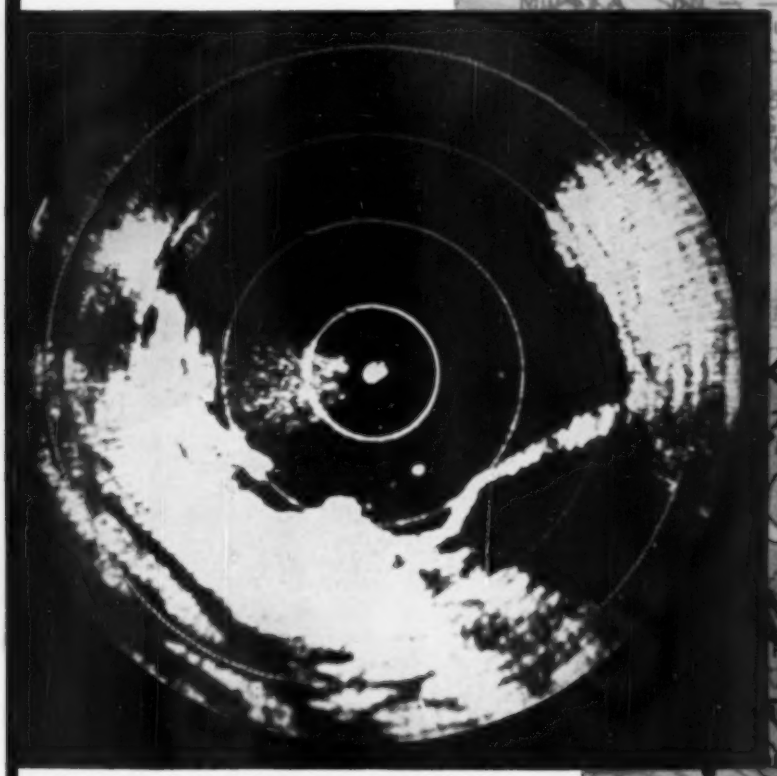
IMATA to Fold?

Ramsay D. Potts, Jr. has resigned as president of the Independent Military Air Transport Assn. to become associate counsel of the Senate Armed Forces Subcommittee set up to evaluate aircraft and guided missile programs, amid reports that IMATA would soon go out of business.

IMATA is reported breaking up under the strains of moves by various members toward other organizations—specifically Slick Airways and the Flying Tiger Line toward Air Transport Assn. and other members toward Air Coach Transport Assn.

Potts' resignation is completely unrelated to the reports of a break-up of the organization.

WHEN A PILOT NEEDS A LANDMARK...



Circled portion of aeronautical chart as seen on scope of AVQ-10 on in-bound airliner (Note Hayward-San Mateo County bridge).

Portion of sectional aeronautical chart looking north on San Francisco Bay area.

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These ground-mapping characteristics are in addition to the recognized superiority of the AVQ-10 as a weather radar. It is the first airborne radar to use the C-band (5.6 cm) transmission, the wavelength best suited to weather detection and avoidance, yet having the least amount of scope clutter. With it, the pilot can evaluate storms 150 miles ahead and pick non-turbulent paths between them. In addition to avoiding costly detours, the AVQ-10 contributes materially to passenger comfort.

All this has made the demand for the AVQ-10 great and pressing. Many leading airlines have already specified it. To secure early installation, other airline and executive plane operators are invited to write now for further information.

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Celler Monopoly Hearing Shifts Focus to Supplemental Carriers

Washington—A House Judiciary Subcommittee shifted focus from Air Transport Assn. to Air Coach Transport Assn., industry organization of supplemental carriers, in its investigation of the suppression of competition in air transportation.

Rep. Emanuel Celler (D.-N. Y.) closely questioned ACTA's witness at public hearings as to whether the organization is dominated by four lines which obtain a lion's share of the military business channelled by ACTA to its 30 members. The four named by Celler were Westair Transport, General Airways, U. S. Overseas Airlines, and Los Angeles Air Service. Four of ACTA's seven directors are officers of these lines.

Warren E. Miller, counsel for ACTA, said he would submit information refuting Celler's suggestions that four lines "operate as a pool," work jointly in the financing and leasing of aircraft, and vote as a unit.

Miller conceded that ACTA management in Washington, operating its exchange board showing the location and availability of the aircraft of its members, has discretion in channelling Civil Air Movements (CAM) business to members. But he firmly protested Celler's suggestion of favoritism. Celler said the subcommittee had information that 75% of the CAM domestic and 50% of the CAM international business was going to the four-line "combinations."

Celler asked what ACTA's position would be "on new members competitive with USOA." Miller replied that ACTA believes "that the smaller carriers should be encouraged."

Other developments:

• **Civil Aeronautics Board** formally declined to disclose proceedings of Board meetings to Celler's group—or other Congressional committees. Celler had insisted that CAB member Joseph Adams disclose statements made by CAB member Harmar Denny at an Apr. 27, 1953 meeting, at which Denny reversed his vote of 17 days earlier and opposed a Board investigation looking to a reduction of domestic airline rates. Denny told the subcommittee that between meetings he had talked with Stuart Tipton, then counsel and now president of Air Transport Assn., which was opposing the investigation. Denny denied that Tipton's statements influenced the change (AW Mar. 19, p. 83).

Two witnesses testified that Denny had made statements at the time that Tipton had convinced him to vote against the investigation. They were Jack Anderson, a reporter for columnist Drew Pearson and Josh Lee, former CAB member.

• **Miller discounted** suggestions—made by Celler—that scheduled airlines have engaged in a "conspiracy" to supress competition. "The aim of the big airlines has been to prevent competition," he said. "So forceful have been their arguments that they have long enjoyed almost a full monopoly, exempt from competition. We do not say there was a conspiracy against the non-scheduled airlines, although over-zealous acts may be found in any conflict so intense." Pointing out that the case of Slick Airlines vs. American Airlines, United Air Lines, Transcontinental and Western Air, and Air Transport Assn., charging a conspiracy, is now pending before the U. S. District Court, Miller said: "It would not be fair to make such a charge at this time. However, the decision of the court or jury in that case . . . may determine this point."

• **Celler declared** that if Civil Aeronautics Board does not take corrective action to end the life-and-death authority of the Air Traffic Conference, a branch of ATA, over travel agents, "Congress will have to step in." At present only agents licensed by ATC may handle the business of scheduled airlines.

Court Orders Review Of EAL Route 6 Case

Washington—The U. S. Court of Appeals has told the Civil Aeronautics Board to review a decision disputed by the Greensboro-High Point Airport Authority and to issue a new, clearly explained opinion.

Eastern Air Lines' Route 6 between Charlotte and Detroit is the point of contention. Eastern is permitted to continue its present services on the route until the difficulty is settled.

Greensboro maintains that the Board discriminated against it when it added Columbus and Toledo to Route 6. In its decision, the CAB set up a new segment between Charlotte and Detroit via Columbus and Toledo. Greensboro feels that splitting the route at Charlotte, which is south of Greensboro, discriminates against Greensboro.

When the CAB examiner recommended the new route segment, Greensboro asked to intervene and was allowed to argue its case. Subsequently, the Board granted the Charlotte-Detroit route to Eastern, and Greensboro petitioned for reconsideration. This move was denied.

The Greensboro-High Point Airport Authority then asked the Appeals Court to review the CAB's action. The authority contended it was denied a fair hearing and said the Board did not state adequate reasons for rejecting Greensboro's contentions.

The court said Greensboro did not receive a plain answer to its charge of discrimination and that it is entitled to one.

The Court said it felt the CAB should now make appropriate findings of fact and state the reasons for its conclusions. The findings can be made on the present record or with additional testimony and argument.

The Court vacated the order of the Board, which also involved a Columbus-Charleston, W. Va., route for Piedmont Airlines, but existing service and route arrangements can remain in effect until the proceeding is completed.

Controllers Wanted

Civil Aeronautics Administration is trying to recruit 300 air traffic control trainees for the standard 10-week course given at Oklahoma City.

The job title for controllers is airways operations specialist. CAA is recruiting at regional offices in Ft. Worth, Tex.; Kansas City, Mo.; Los Angeles, Calif.; and at New York International Airport. Trainees selected must have 2½ years experience, either in air traffic control, as a dispatcher, 3 years in air/ground communications; or must be pilots with instrument ratings and 400 hours of flying.

Fares to South America To Be Reduced by 30%

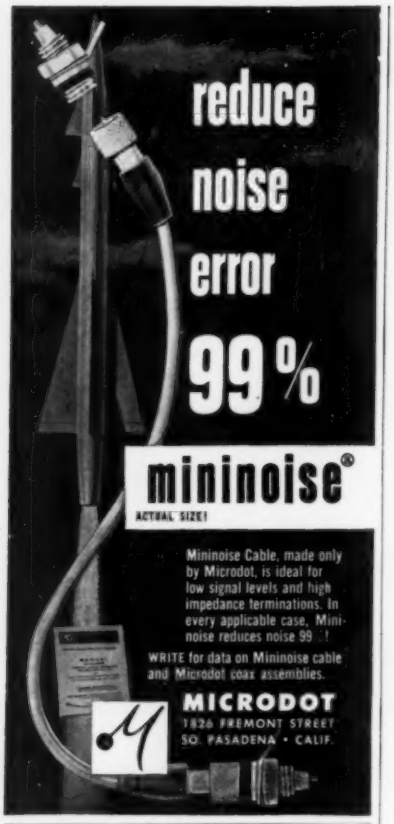
Airlines serving South America plan to cut fares about 30% with the introduction of a new excursion fare from North American points.

Braniff Airways, Pan American World Airways and Pan American-Grace Airways have announced they will introduce the new fare Apr. 23 for use on both first class and tourist services.

The excursion fare can be used by travelers flying to Lima, La Paz, Rio de Janeiro and points to the South. Aimed at promoting group travel, the fares apply to roundtrip flights completed within 30 days by groups of two people or more.

The new fare is a reduction of 30% from the cost of two regular one-way fares.

Stopover privileges are included in the deal for passengers who want to see more than one city on their trip.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CAB Orders

(March 15-21)

GRANTED:

Northwest Airlines an exemption for its military charter operations in the Pacific area during the months of April, May and June, 1956.

Midet Aviation Corp. authority to do business as Midet Airlines, with certain provisions.

Continental Air Lines an exemption to serve Ft. Worth as an intermediate point on Segment 2 of Route 64 between Dallas and Waco on one round trip daily.

Northwest Airlines and Capital Airlines leave to intervene in the route restriction investigation.

Leave to intervene in the reopened Transpacific Certificate Renewal Case to the Los Angeles Chamber of Commerce, the San Francisco Chamber of Commerce and the City and County of San Francisco. Petition of the Harbor Commission of the City of San Diego was denied.

Riddle Airlines permission to serve Louisville, Ky., through Standiford Airport.

Seaboard and Western Airlines authority to enter lease and option agreements with International Aviation Corp. involving the lease of one Super Constellation aircraft and four spare Wright engines, with a purchase option at the end of the seven year lease.

ORDERED:

Wien Alaska Airlines' temporary authority to operate to Barter Island, Alaska, from various points extended to 60 days after final decision in the Investigation of Intra-Alaska Air Services Case.

Pan American World Airways' and Trans World Airlines' applications for certificate amendment consolidated into a single proceeding. American Airlines, Northwest Airlines, United Air Lines, Western Air Lines, Los Angeles Chamber of Commerce, Portland Chamber of Commerce, Portland Freight Traffic Assn., Port of Portland, Ore., City and County of San Francisco, San Francisco Chamber of Commerce, Seattle Chamber of Commerce, Seattle Traffic Assn. and the Washington Public Service Commission were granted leave to intervene in the case.

Wien Alaska Airlines to show cause why the Board should not set mail rates of 98.98 cents a mile for the period July 1, 1955 to Oct. 31, 1955; 150.94 cents for the period Nov. 1, 1955 to Apr. 30, 1956 and the like six month period in each succeeding year; and 98.98 cents for the period May 1, 1956 to Oct. 31, 1956 and the like six month period in each succeeding year.

Proceeding established to review North Central Airlines' service between Duluth-Superior and Chicago, and the issue of continued suspension or elimination of service by Northwest Airlines to Duluth-Superior, Green Bay, Wassau, La Crosse and Eau Claire.

Phoenix Service Case consolidation order corrected to clarify the scope of Trans World Airlines' and Western Air Lines' applications. Leave to intervene was granted to American Airlines, City and County of Alamosa, Alamosa County Chamber of Commerce, Alamosa Airport Board of Control, City and County of Denver, City of Farmington and Farmington Chamber of Commerce, Town of Gallup and Gallup Chamber of Commerce, County of Maricopa, City of Mesa and Mesa Chamber of Commerce, City of Monte Vista, City of Palm Springs, Phoenix Chamber of Commerce, Utah State Aeronautics Commission, Salt Lake City Corp. and Chamber of Commerce, County of San Diego and San Diego Harbor Commission. Various other municipalities and organizations were denied leave to intervene.

Caribbean-Atlantic Airlines to show cause why the Board should not set a final mail rate of $1.38 per mail ton-mile for the period starting July 1, 1955.

Data submitted to the CAB by Alaskan pilot-owners as periodic financial and operating statistical reports between June 30, 1948 and Mar. 19, 1956 released for public information.

Capitol Airways' application for Nashville-Birmingham service and Riddle Airlines' application to serve Nashville severed from consideration in the Great Lakes-Southeast Service Case. Leave to intervene in the case was granted to Piedmont Aviation, Southern Airways, and the City of Cincinnati, Ohio.

DENIED:

Application of Walla Walla, Wash., for an exemption for United Air Lines from the provision of its certificate which requires a stop at Pendleton, Ore., or for designation of Walla Walla as a co-intermediate point with Pendleton.

Air Freight Forwarders Assn.'s motion to include shippers' associations in the investigation of minimum rates for air freight forwarders.

North Central Airlines' request for permission to file an exception to the examiner's report in the Chicago Area Service Case after the expiration date.

Shortlines

► **Alitalia,** the Italian airline, plans to start a Rome-Baghdad service around the first of May. This service is the first of several planned for the Middle East this summer.

► **American Airlines** has produced a booklet called "The Eye and the Echo" to explain airborne radar to the traveling public in layman's language.

► **Avianca,** Colombian National Airways, reports that traffic between New York, Jamaica and Colombia increased 12% last year. Avianca carried 26,751 passengers on the New York route and 57,504 passengers on all international services in 1955.

► **Continental Air Lines** inaugurated Convair 440 service on its routes Apr. 1. All three of Continental's new Convair 440 Metropolitans are equipped with C-Band radar.

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P-9534, Aviation Week
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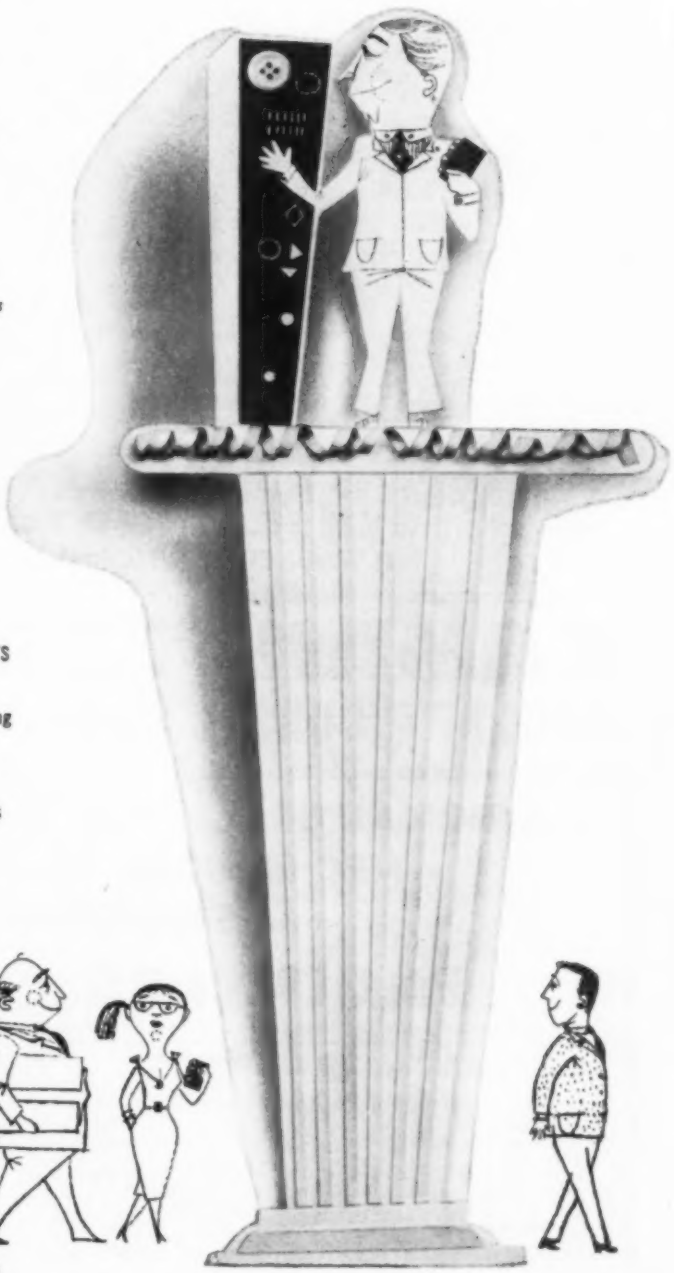

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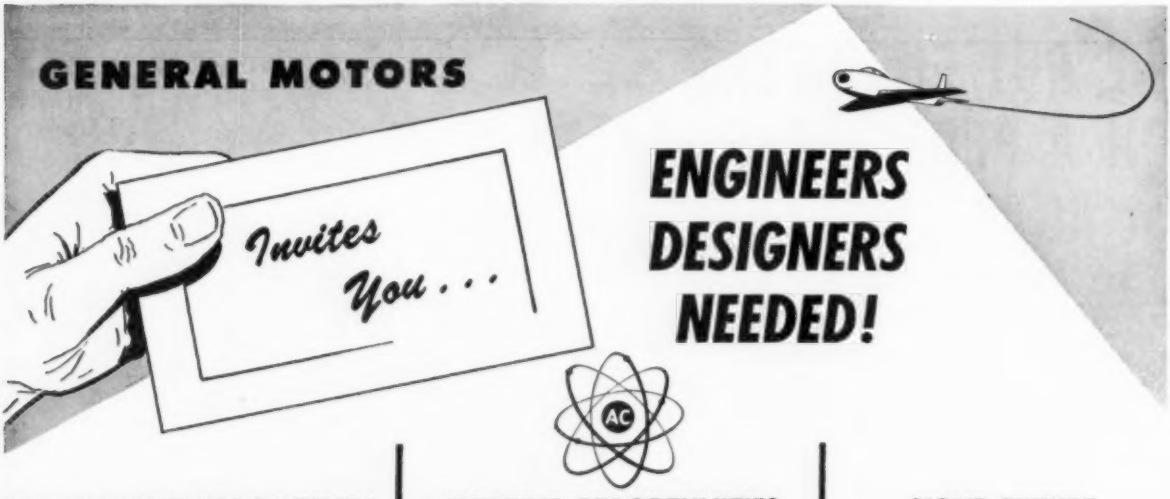

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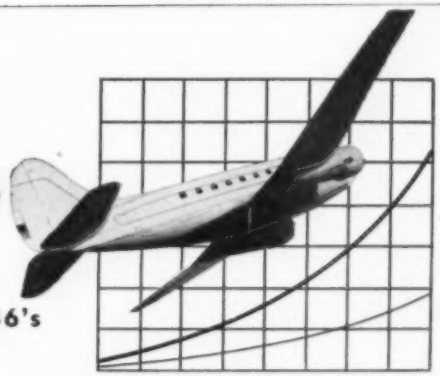

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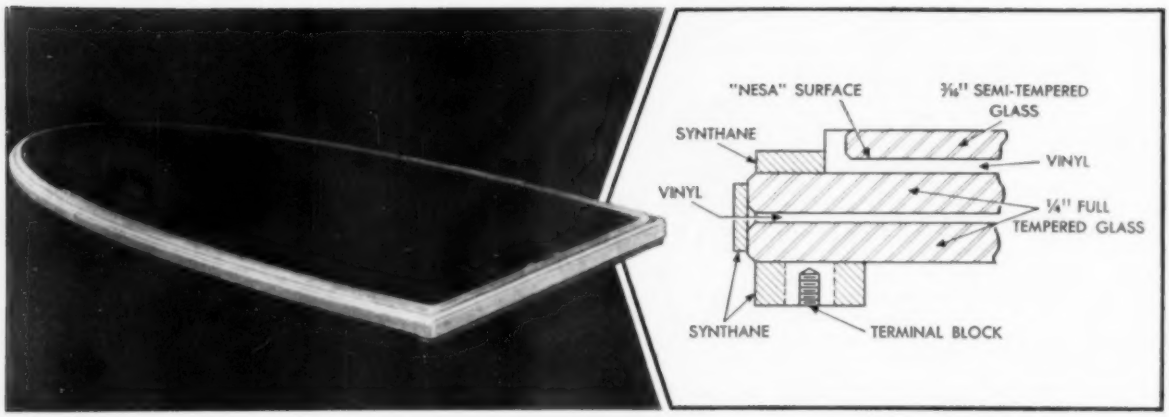
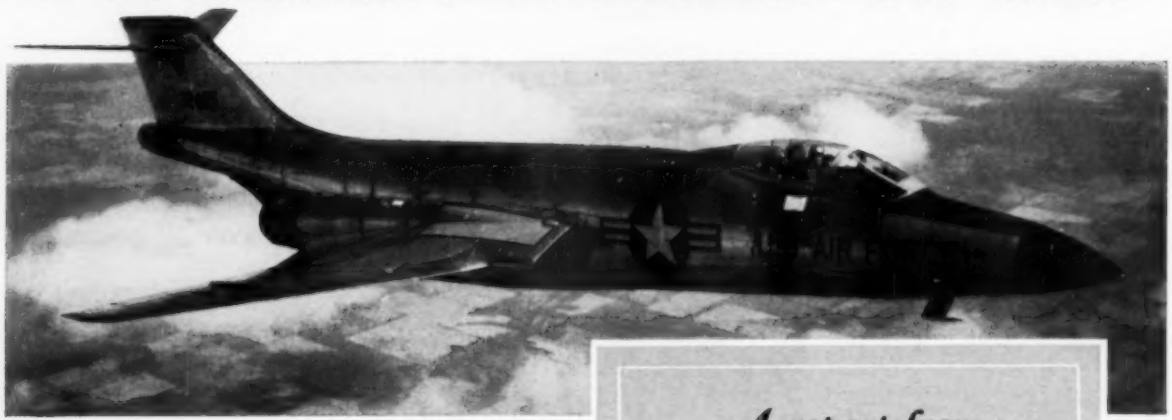


How electrically-heated Multiplate "NESA"® is used in the windshield of the McDonnell F-101A Voodoo



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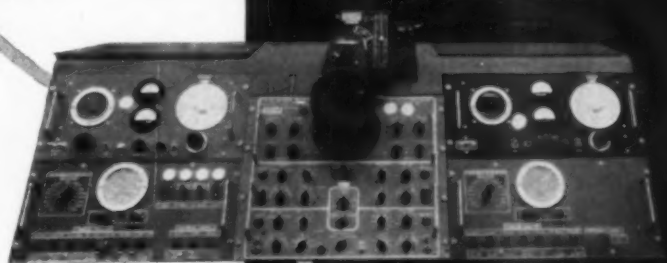

Above photo shows portion of telemeter ground station test unit of Convair's Guided Missile Plant in Pomona, Cal., using the NEMS-CLARKE Receiver.

For further details
Write Dept. B-2

NEMS-
CLARKE
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PRECISION ELECTRONIC INSTRUMENTS
SILVER SPRING, MARYLAND

LETTERS

Circuit-Breaker Safety

In the interest of greater aviation safety, the "CAB Report on Pan American B-377 Crash off Oregon" (AVIATION WEEK, January 2, 1956) should be amplified with certain clarifying facts.

After describing the loss of the No. 3 engine, the report then goes on to discuss the "Inability to Increase RPM." The flight engineer attempted to increase RPM by use of all switches simultaneously, including the switch controlling the shorted circuit for the lost No. 3 engine. Naturally, the master circuit breaker tripped. Since the fuses protecting the individual circuits were subsequently reduced from 5 amp. to 2 amp., it should be obvious that the original rating was too high.

At this point, the report makes reference to a Service Bulletin calling for replacement of the magnetic circuit breakers by slower acting thermal circuit breakers.

There seems to be a misunderstanding that magnetic circuit breakers are instantaneous and thermal circuit breakers are slow acting. While the magnetic circuit breaker on this application was of the instantaneous design, magnetic circuit breakers with time delay are generally used and might be more suited to this application.

It is important to realize, however, that switching to slow acting thermal-type circuit breakers might only compound the control problem as brought out by this incident. Time was an important element in this emergency so that the waiting time before a thermal circuit breaker could be reset could be a substantial consideration.

With the magnetic time-delay circuit breaker, a time-delay inversely proportional to the overload is provided before tripping; however, the circuit can be restored immediately after a fault is cleared. There is no waiting for the circuit breaker element to cool before restoring these vital control circuits.

B. A. BERLIN, President
Heinemann Electric Company
Trenton 2, New Jersey

Controller's Task

Permit me to congratulate Capt. R. C. Robson and you enthusiastically on your article, "Cockpit Viewpoint" in the Feb. 20th issue of AVIATION WEEK.

Capt. Robson's article accurately describes the condition under which a great many Air Route Traffic Controllers work. We are asked, and do, a job with tools and facilities that were obsolete many years ago. The average take home pay for an Air Route Traffic Controller is $95 per week. During an eight-hour watch he protects, clears and assists many pilots and millions of dollars worth of aircraft. One wrong word could mean the loss of many human lives and millions to the aviation industry.

The Air Route Traffic Controller is a human being, still there is no allowances made for human error, eight hours a day, day after day, he is to perform the impossible, with never a word of appreciation.

The men that make up the staff of our Air Route Traffic Control Centers are dedicated to aviation, and their purpose is the Safe, Orderly and Expeditious flow of air traffic.

We all read your publication AVIATION WEEK, keep up the good work.

ARTHUR W. BOLAND
Airways Operation Specialist
12115 S. Hindry Avenue
Hawthorne, California

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

DME Blessings

Captain Robson's "Communications Burden" (AW Feb. 27, p. 110) could be lightened considerably through utilization of DME (Distance Measuring Equipment). The example used by Captain Robson could be solved upon reaching Freehold, in the following manner.

Assuming Colts Neck VOR/DME tuned in and furnishing continuous, accurate position information, instead of a vague three-to-five mile fan marker approximation, it's with a good deal of authority that you report "over Freehold." Then in one, unharried tuning session, ADF's are tuned to LaGuardia low frequency range and Flatbush homer, the other omni/DME receiver tuned to LaGuardia ILS/DME and except for retuning the ADF's to the ILS compass locators, that's it come Reagan, Coney or "what's your position now American 3?"

Best of all there's that "tranquillity of spirit" that comes from knowing with certainty just where in that murk you really are.

Who knows, maybe if we would all install DME CAA would do away with those intersections.

JOHN F. McCORMICK
P. O. Box Municipal Airport
Salt Lake City, Utah

'Coanda' Dirigible

I am interested and somewhat puzzled at the recent applications of the "Coanda effect," as if it were something new. I have in mind, a project started in 1926 by Mr. Thomas Slate of the Slate Aircraft Co. of Glendale, Calif. The project applied the "Coanda effect" to an all-metal dirigible, the method of propulsion being a flat-bladed impeller mounted on the nose of the ship. The air, moving out in all directions from the center, followed the contour of the ship from fore to aft, giving it a forward thrust of unbelievable force. This was demonstrated in tests of the working model. The main hindrances to speed, found in conventional dirigibles, were minimized in this revolutionary model. Surface drag was minimized by the boundary layer motion and frontal resistance by the air itself being displaced from in front of the ship.

The ship was completed in 1929 and the time came for the test flight. The sun was shining and the expansion value did not release. The metal bag split open and the ship was extensively damaged. Project was dropped because of inability to continue the program.

Until recently, it appears that there has been little exploitation of this potential. After this contribution of effort and research made by Slate Aircraft, it seems that possibly the aviation industry, especially lighter-than-air, has lost something by not following through on this principle.

With a plug for your very fine magazine, I remain,

CARTER W. CHRISTENSEN
2131 Baxter St.
Los Angeles 39, Calif.

Annular-Wing History

May I hasten to assist in keeping the historical records straight as Mr. Werner E. Herrmann so aptly puts it in his letter appearing in your March 5 issue.

In 1909 while with the Moisant International Aviators of Winfield, L. I., the writer built and flew an annular wing VTOL.

In 1919, with the assistance of the late Professor Alexander Klenin, the wind tunnel tests were made in the four-ft. tunnel of The Guggenheim School of Aeronautics at N. Y. University.

The idea was considered so revolutionary that it was not patented at that time but is only now in process.

Unlike the coleopter, this vertiplane does not require any transition period from a vertical position to horizontal position in forward flight.

This machine rises vertically—hovers easily, and remains on same axis of flight throughout the whole range.

It travels either backwards or forward after reaching altitude.

Is easily adaptable to existing missiles.

Can take off like conventional planes or STOL's.

Can land in power off condition from 300 ft. altitude more readily than present day helicopters.

Has excellent gliding angle.

Can be flown as kite or tow glider.

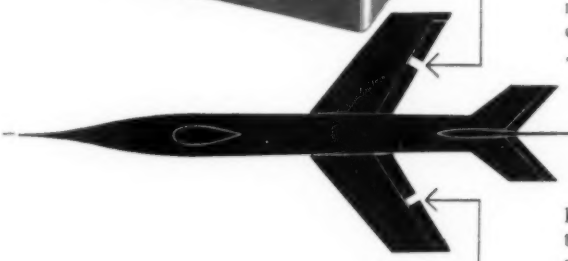
Its cheap, lightweight construction affords excellent pay load and requires small storage space—it being collapsible.

I have been collecting VTOL and helicopter photos and other data from all over the world since 1908 and as yet have not found any successful annular wing devices prior to 1909.

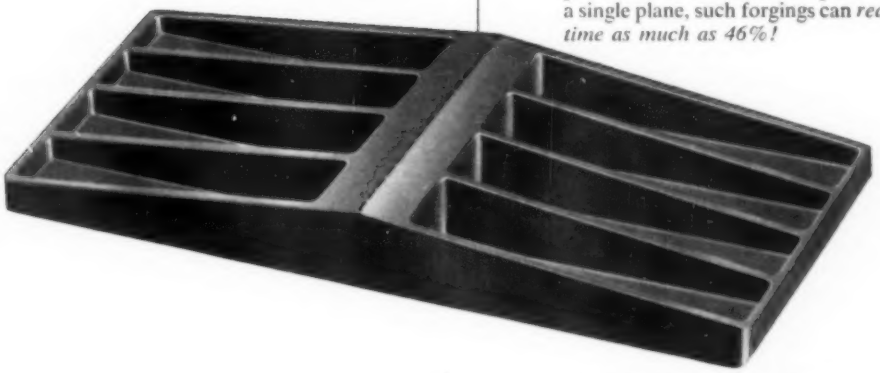
E. S. C.

Harvey precision forgings... fewer machining hours, more flying hours

This is the old way of making an aileron actuator attach fitting . . . machining it from aluminum billet stock. It has three drawbacks. First, it adds many hours to plane construction time . . . second, it requires specialized, expensive machinery . . . third, it can *waste up to 90% of the metal.*



Here's a Harvey *precision* aluminum forging, two fittings produced as one piece, then cut apart. Zero draft eliminates slow, costly counterboring or back spot-facing . . . forging to finished-part dimensions avoids complex machining. On a single plane, such forgings can *reduce machine time as much as 46%!*



Harvey is a leading independent producer of aluminum extrusions in all alloys and all sizes, special extrusions, press forgings, hollow sections, structurals, rod and bar, forging stock, pipe, tube, impact extrusions, aluminum screw machine products and related products. Also similar products in alloy steel and titanium on application.

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Lockheed C-130 Hercules to provide jet age transport speed with Allison Turbo-Prop Engines and Aeroproducts Propellers

Now in production at Government Aircraft Plant No. 6, Marietta, Georgia, the Air Force's first turbo-prop transport before long will begin active service with the USAF Tactical Air Command.

Powered with four Allison T56 engines and Aeroproducts Propellers, the new Lockheed Hercules will add speed and load-carrying ability to the logistics support of our jet-powered combat forces.

Now undergoing the rigid test of cold weather operation in the climatic test hangar at Eglin AFB—home of the Air Proving Ground Command—the C-130 will be proved fit and ready when it reports for duty some time this year.

Already the matched team of Allison engines and Aeroproducts Propellers stands as the most thoroughly proved turbo-prop power package in America. In military – as well as in commercial service – it is ready to take its place in the jet age of air transportation.

Backed by more than 8 million hours of turbine engine flight time—experience where it counts most—in the air!

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